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A preliminary review of the Annulariidae (Gastropoda: Littorinoidea) of the Lesser Antilles

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ABSTRACT

The Annulariidae of the Lesser Antilles, including the Virgin Islands, Isla de Vieques, and Isla Culebra, are reviewed. Eleven species are recognized in three genera. With rare exceptions, all occur in the Limestone Caribbees. One species, *Parachondria basicarinatus* (Pfeiffer, 1855), from St. Croix, may be extinct. All are believed to be related to Puerto Rican taxa.

Additional Keywords: Caribbean, operculate, land snails

INTRODUCTION

The Annulariidae are a speciose group (ca. 700 species) of calciphile land snails endemic to the Caribbean region (Watters, 2006). Although they have been extensively reviewed for Cuba (Torre and Bartsch, 1938; 1941), Hispaniola and the Bahamas (Bartsch, 1946), Puerto Rico (van der Schalie, 1948), Central America (Solem, 1961), and South America (Solem, 1960), no such review exists for the Lesser Antilles. As such, the systematics of this group in the Lesser Antilles was far from settled. This preliminary review examined >2200 specimens in >170 lots. Of the 19 nominal taxa described from the Lesser Antilles, the types are presumed lost for 13 (68%), the types have never been illustrated for seven (37%), and for five (26%) the types were both never illustrated *and* are presumed lost. The type locality for six (32%) does not mention any particular island.

The Virgin Islands, Isla de Vieques, and Isla Culebra are variously considered members of either the Greater or the Lesser Antilles. They are here included in the Lesser Antilles and are part of this report. The Netherlands Antilles (Aruba, Bonaire, and Curaçao) and Trinidad, also sometimes included in the Lesser Antilles, are not included here; their fauna does not seem to be related to the other Lesser Antillean annulariids discussed here.

Despite their abundance in the Greater Antilles, annulariids are not widely distributed in the Lesser Antilles. Their presence or absence on any island appears to be dictated by large-scale ecological constraints. These constraints are tied to the geological history of the region. The largest part of the Lesser Antilles consists of a volcanic arc of islands on the eastern edge of the east-moving Caribbean Plate extending from Puerto Rico to South America. Many of these volcanos remain active today and are dispersed along the arc from Saba to Grenada. At approximately half way on the arc, near Martinique, the arc splits to the north into two closely diverging secondary arcs. The eastern arc, the Limestone Caribbees, is the older (possible Eocene) and no longer has active volcanoes. The younger western arc (the Volcanic Caribbees, Miocene) has numerous volcanoes (Bouysse et al., 1990). Guadeloupe, near the split, is actually two islands, Basse-Terre in the western arc and Grand-Terre in the eastern arc, connected by an isthmus. Although the islands of the Lesser Antilles are largely igneous, the older islands of the eastern arc have been overlain with carbonate deposits. It is not surprising therefore that these calciphile snails occur almost exclusively on the islands of this eastern arc. With very rare exceptions, none occur in the western arc and none occur south of Martinique until Trinidad. These snails are therefore limited to non-actively volcanic, carbonate islands – the Limestone Caribbees and Trinidad. Although portions of St. Lucia and all of Barbados are sedimentary, no annulariids are recorded from there.

Northwest of these arcs, adjacent to Puerto Rico, are the Virgin Islands, Isla de Vieques, and Isla Culebra. Except for St. Croix, all are part of the Puerto Rico-Virgin Island Platform and are geologically separate from the rest of the Lesser Antilles. This limestone platform dates from the Oligocene (van Gestel et al., 1998). During the Last Glacial Maximum all were connected by dry land and all could have shared the same snail fauna. This division between the Virgin Islands and the rest of the Lesser Antilles is evident in the distributions of the species covered here as well. There is no overlap between the two groups.

St. Croix constitutes its own platform and may have moved from the forearc to the backarc in the Paleogene (Speed, 1989). It is separated from Puerto Rico and the remaining Virgin Islands by the Virgin Islands Basin (4500 m deep) and the Anegada Passage (1800 m deep) and was therefore never connected with them during

the Last Glacial Maximum. This island has the highest diversity of annulariids of the Lesser Antilles, but at least one species appears to be extinct and others may be confined to small areas of the island. Most species occur in the uplands in the northeastern part of the island. St. Croix is perhaps the most developed of the Lesser Antilles but the upland region has not been extensively altered.

Unlike Jamaica and portions of Hispaniola, the Lesser Antilles are not rafted portions of a proto-Central America but are volcanic islands that arose *de novo*. While the annulariid fauna of Jamaica and Hispaniola may have evolved in place, the fauna of the Lesser Antilles must have originated elsewhere. Two routes are available: from Puerto Rico or from South America (or a combination of both). Iturralde-Vinent and MacPhee (1999), in their GAARlandia theory, hypothesized that the biota of the Antilles in general had originated in South America and dispersed through the Lesser Antilles on a dry land bridge they termed the Aves Arch. If this is the case then, with the exception of offshore Trinidad, all annulariids have vanished from the Lesser Antilles from South America to Martinique leaving only taxa in the northern half of the arc. However, few (perhaps none) of the species in South America or Trinidad are congeneric with those in the Lesser Antilles. But all of the genera in the Lesser Antilles may be found in Puerto Rico (*Chondropoma*, *Diplopoma*, *Parachondria*). It is apparent that the dispersal pattern is from Puerto Rico to the adjacent Virgin Islands and from there to a few select islands in the northern Lesser Antilles, eventually dissipating in diversity by Martinique. Only three species occur south of the Virgin Islands to Trinidad. Only Trinidad appears to have derived its fauna from South America, only 11 km away.

Radiation within the Lesser Antilles probably has involved several mechanisms. Dispersal over land during lower ocean levels undoubtedly accounts for distributions in the Virgin Islands (except St. Croix) and between Antigua and Barbuda and between Anguilla and Saint Martin. But dispersal over water by either rafting or air borne must be invoked for radiations to St. Croix and Guadeloupe, both of which are separated from the next nearest source by distances of over 50 km and deep channels, the latter of which would preclude connections during the Last Glacial Maximum. Rafting might be most likely due to hurricanes dislodging vegetation containing the snails, which then drifted to other islands. Such dispersal has been recorded for iguanas rafted from Guadeloupe to Anguilla by Hurricane Luis, a distance of over 200 km (Censky et al., 1998). Annulariids, which can survive long periods behind nearly hermetically sealed opercula if not immersed, are good candidates for rafting. Rafting could also explain the patchy distribution of annulariids in the Lesser Antilles. Because rafting to islands of the western arc from the eastern arc would be just as probable as anywhere else, the absence of annulariids on those islands seems to be due to the ecological factors previously mentioned.

Shuttleworth (1858), Bland (1861), Mazé (1890), and Vernhout (1914) listed species records from localities that cannot be confirmed here. Some of their records seem out of the expected range of these species. Given the uncertainty of species identification at that time I view these records with skepticism until additional collections uphold them.

MATERIALS AND METHODS

Descriptions and measurements were made on shells oriented with the spire up and the aperture facing the viewer. Length was measured from the tip of the protoconch (or teleoconch of decollate specimens) to the opposite anterior-most extension of the outer lip, perpendicular to the coiling axis. Width was measured from the left edge of the adult whorl to the opposite maximum right extension of the outer lip. Subsets of specimens were measured to determine the minimum, maximum, and average lengths. The number of whorls was determined using the 1 D method of Van Osselaer (1999) in which the starting point is tangential to the suture. Numbers in parentheses in **Type Material** and **Other Material** refer to the number of specimens in the lot. **Chresonymies** (all references) are given instead of synonymies (only primary changes); unless attributed to another author, synonyms are based on this review.

Abbreviations used in the text are: GTW: Collection of the author; MNHG: Muséum d'Histoire Naturelle, Genève, Switzerland; OSUM: Ohio State University Museum of Biological Diversity, Columbus, Ohio, USA; SMF: Naturmuseum Senckenberg, Frankfurt am Main, Germany; UF: Florida Museum of Natural History, Gainesville, Florida, USA; ZMB: Museum für Naturkunde Berlin, Germany.

SYSTEMATICS

Family Annulariidae Henderson and Bartsch, 1921
Subfamily Chondropomatinae Henderson and Bartsch, 1921

Genus *Chondropoma* Pfeiffer, 1847a

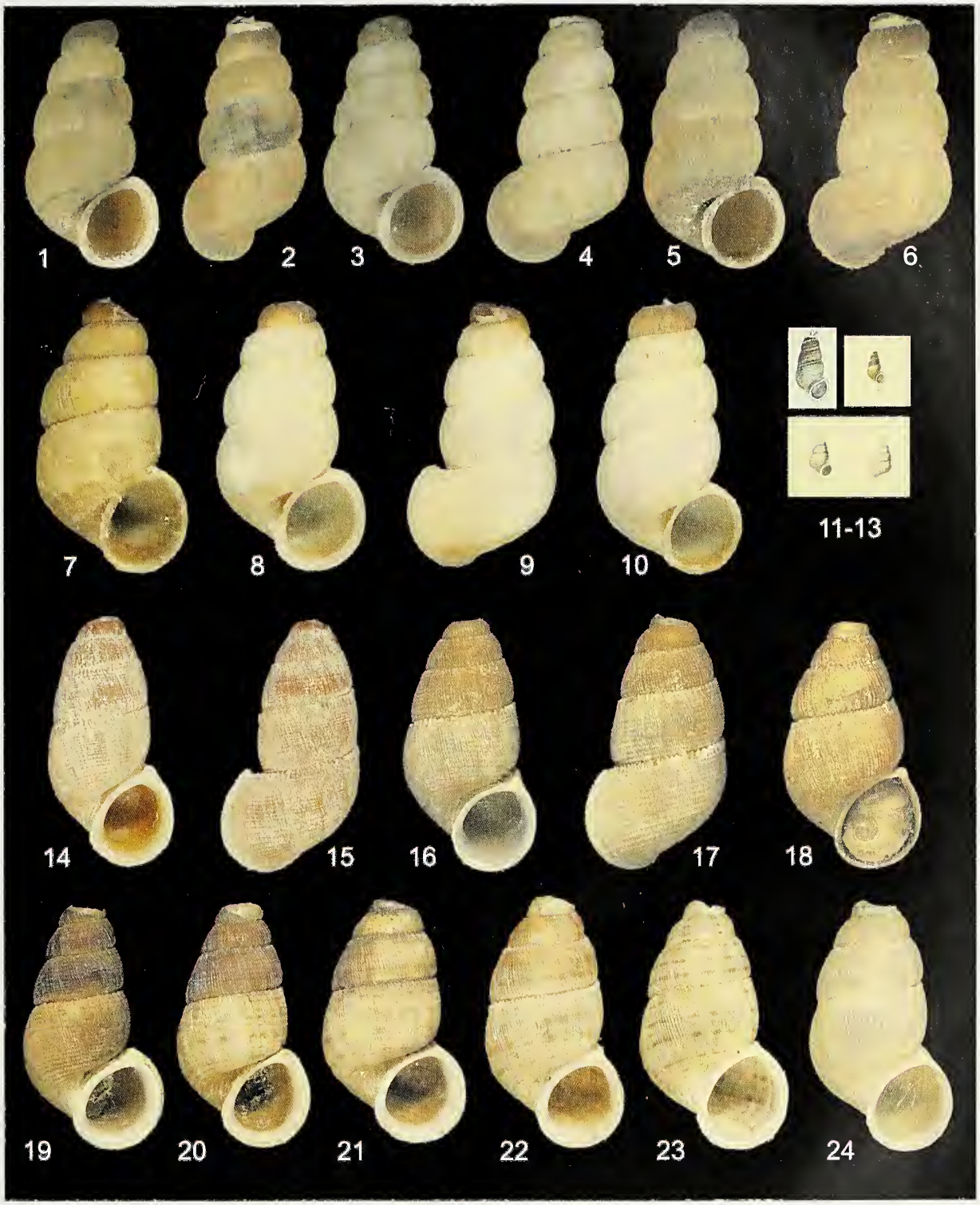
Subgenus *Chondropoma* Pfeiffer, 1847a

Type Species: *Cyclostoma sagra* d'Orbigny, 1842, by subsequent designation of Petit de la Saussaye, 1850.

Chondropoma (*Chondropoma*) *julieni* Pfeiffer, 1866
(Figures 1–10, 135)

Chresonymy

Chondropoma julieni Pfeiffer, 1866: 89; Pfeiffer, 1876a: 192; Mazé, 1890: 32; Vernhout, 1914: 183, 187; Coomans, 1967: 126; Watters, 2006: 319.
Choanopoma julieni (Pfeiffer, 1866). —Tryon, 1867: 99.
Chondropoma (*Chondropoma*) *julieni* Pfeiffer, 1866. — Henderson and Bartsch, 1921: 62; Watters, 2006: 28, 319.



Figures 1–24. *Chondropoma* species. **1–10.** *Chondropoma julieni* Pfeiffer, 1866. **1–6.** Probable syntypes of *Chondropoma julieni* Pfeiffer, 1866, Sombrero Island, ZMB 65674. **1–2.** Ca. 10.5 mm. **3–4.** Ca. 9 mm. **5–6.** Ca. 7 mm. Photos courtesy Christine Zorn, ZMB. **7.** Sombrero Island, UF 216657, 11.1 mm. **8–9.** Sombrero Island, UF 216657, 10.9 mm. **10.** Sombrero Island, UF 216656, 9.0 mm. **11–24.** *Chondropoma pupiforme* (Sowerby, 1843). **11.** Type figure of *Cyclostoma pupiforme* Sowerby, 1843: 102, pl. 24, fig. 43. **12.** Type figure of *Chondropoma igneum* Reeve, 1863b: pl. 11, fig. 88. **13.** *Cyclostoma pupiforme* Pfeiffer, 1847c: pl. 14, figs. 15, 16. **14–15.** W of South Hill Village, Anguilla, UF 48725, 15.2 mm. **16–17.** Anguilla, OSUM 4143, 13.0 mm. **18.** Near Philipsburg, Sint Maarten, OSUM 4129, 10.3 mm. **19.** Anguilla, GTW 14639a, 12.3 mm; **20.** The Valley, Anguilla, UF 48727, 10.7 mm; **21.** The Valley, Anguilla, UF 48727, 10.5 mm. **22.** Katouche Bay Valley, Anguilla, UF 48714, 9.6 mm. **23.** Isaac's Cove, Blackgarden Bay, Anguilla, UF 48715, 10.0 mm. **24.** Isaac's Cove, Blackgarden Bay, Anguilla, UF 48715, 10.2 mm.

Figures 25–37. *Chondropoma rufilabre* (Potiez and Michaud, 1838). **25–26.** Type figure of *Cyclostoma rufilabrum* Potiez and Michaud, 1838: pl. 24, figs. 20, 21. **27.** *Chondropoma rufilabre* ("Beck") in Reeve, 1863b: pl. 10, fig. 73a. **28–29.** St. Croix, OSUM 36197, 10.6 mm. **30.** St. Croix, OSUM 36212, 11.1 mm. **31.** St. Croix, UF 7597, 10.3 mm; **32.** St. Croix, UF 216802, 10.3 mm; **33.** Rust op Twist, St. Croix, UF 27962b, 11.8 mm; **34.** St. Croix, UF 7597, 13.2 mm. **35.** St. Croix, UF 118887, 9.9 mm. **36.** Rust op Twist, St. Croix, UF 27962b, 12.1 mm. **37.** Davis Bay, St. Croix, UF 27957, 9.2 mm.

Description: Shell small for genus (smallest=9 mm, largest=11.1, average=10.3, decollated), elongate conic, whorls adnate [attached to previous whorl] except for very short length just before lip. Umbilicus open but narrow, partially obscured by outer lip. Protoconch lost in all examples seen; Pfeiffer (1866) mentions "three obtuse whorls." 3.75–4 decollated whorls remaining. Spiral sculpture of numerous, very fine threads (ca. 20), each separated by a space equal to width of thread. Subsutural and umbilical threads strongest but threads may be indistinct over most of whorl surface. Axial sculpture of numerous, very fine, closely spaced lamellae, best developed over spiral sculpture. Intersections of axial and spiral threads form a minutely scalloped, almost frosted, sculpture. Suture deeply incised, sutural tufts absent. Aperture composed of an inner and an outer lip, oval, barely adnate to previous whorl. Inner lip smooth, inconspicuous, flush with outer lip. Outer lip narrowly laterally expanded, narrowest toward umbilicus, slightly auriculate. Base color of shell white to tan. Most specimens patterned with faint, broken, brown spiral bands; usually one or two darker, unbroken bands occur half way between periphery and umbilicus. First remaining whorl dark brown to reddish. Lip white, unpatterned. Interior of aperture tan to a greater or lesser degree. Operculum, radula, and anatomy unknown.

Type Material: Three specimens, ZMB 65674, collected by Alexis B. Julien from Sombrero Island, from the Pfeiffer collection, generally match Pfeiffer's overall description (Figures 1–6). None are the stated size of 12 mm in length, the largest being approximately 10 mm. They probably are syntypes but this cannot be shown with certainty. Additionally, Pfeiffer's material was not located by me at NHMUK in 2004.

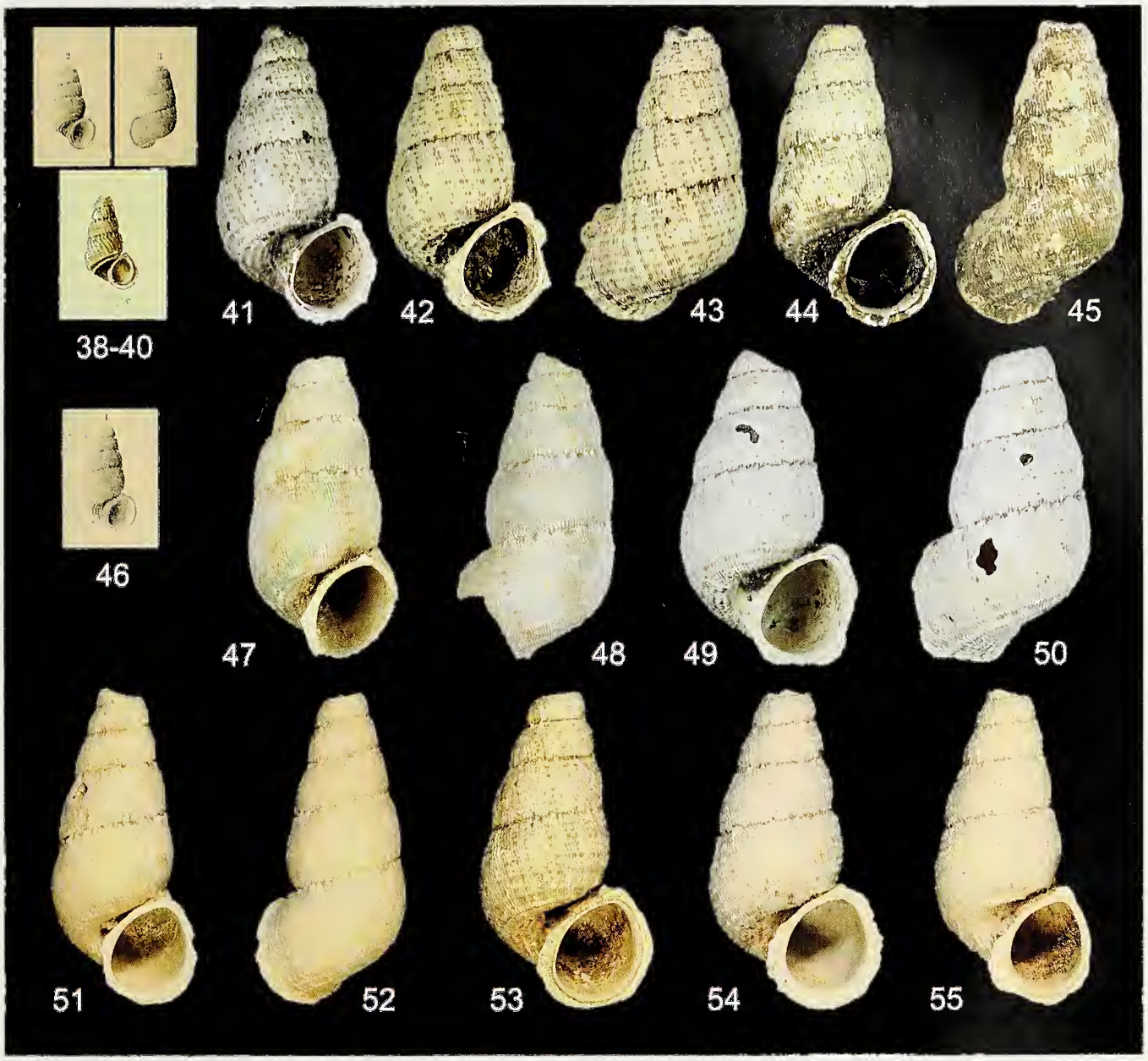
Type Locality: *"in insulae Sombrero."*

Type Figure: Unfigured.

Other Material (Specimens Examined: 3): Sombrero Island, UF 216656 (1), UF 216657 (2).

Distribution: Sombrero Island: This species is probably endemic to the island. It was reported from Saint Martin by Vernhout (1914) and from Guadeloupe by Mazé (1890) but these are undoubtedly misidentifications for the superficially similar *Diplopoma crenulatum* recorded from both islands. Sombrero Island is now uninhabited but was intensively mined for guano prior to 1890. During hurricanes, waves may completely wash over the island, which is only 12 m above sea level.

Habitat: Not reported.

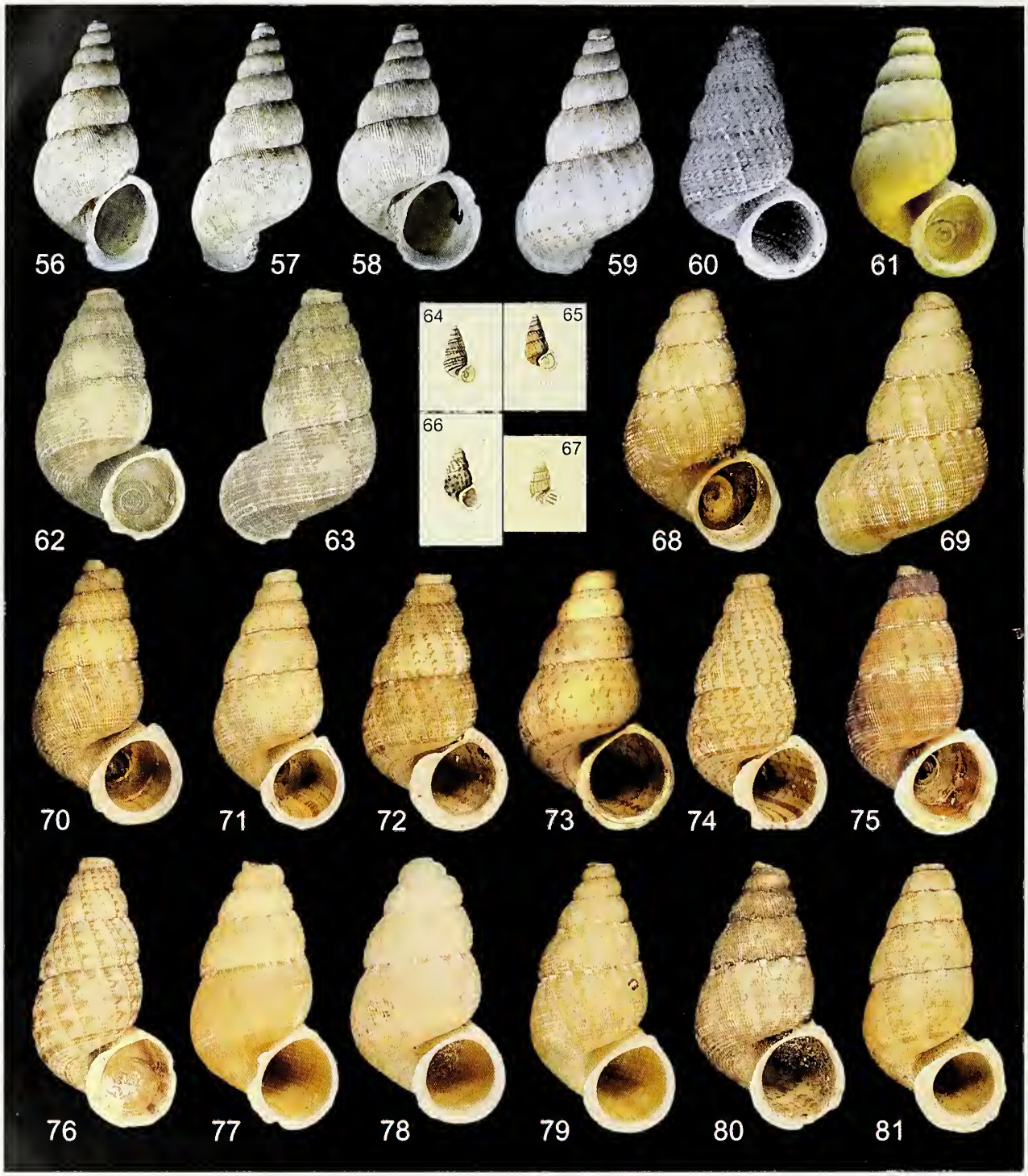


Figures 38–55. *Parachondria basicarinatus* (Pfeiffer, 1855). **38–39.** Type figure of *Cyclostoma basicarinatum* Pfeiffer, 1855, in Pfeiffer, 1855: pl. 4, figs. 2, 3. **40.** ?*Chondropoma basicarinatum* (Pfeiffer, 1855) in Reeve, 1863a: pl. 8, fig. 58. **41–45.** Possible syntypes of *Cyclostoma basicarinatum* Pfeiffer, 1855, ZMB 96810, all ca. 19 mm, photos courtesy Christine Zorn, ZMB. **46.** Type figure of *Cyclostoma chordiferum* Pfeiffer, 1855, in Pfeiffer, 1855: pl. 4, fig. 1. **47–50.** Possible syntypes of *Cyclostoma chordiferum* Pfeiffer, 1855, ZMB 1231, photos courtesy Christine Zorn, ZMB. **47–48.** ZMB 1231-1, 22 mm. **49–50.** ZMB 1231-2, 17 mm. **51–52.** St. Croix, UF 27927, 23 mm. **53.** St. Croix, UF 18318, 19.6 mm. **54.** Frederiksted, St. Croix, UF 27890, 16.4 mm. **55.** St. Croix, UF 27922, 20.2 mm.

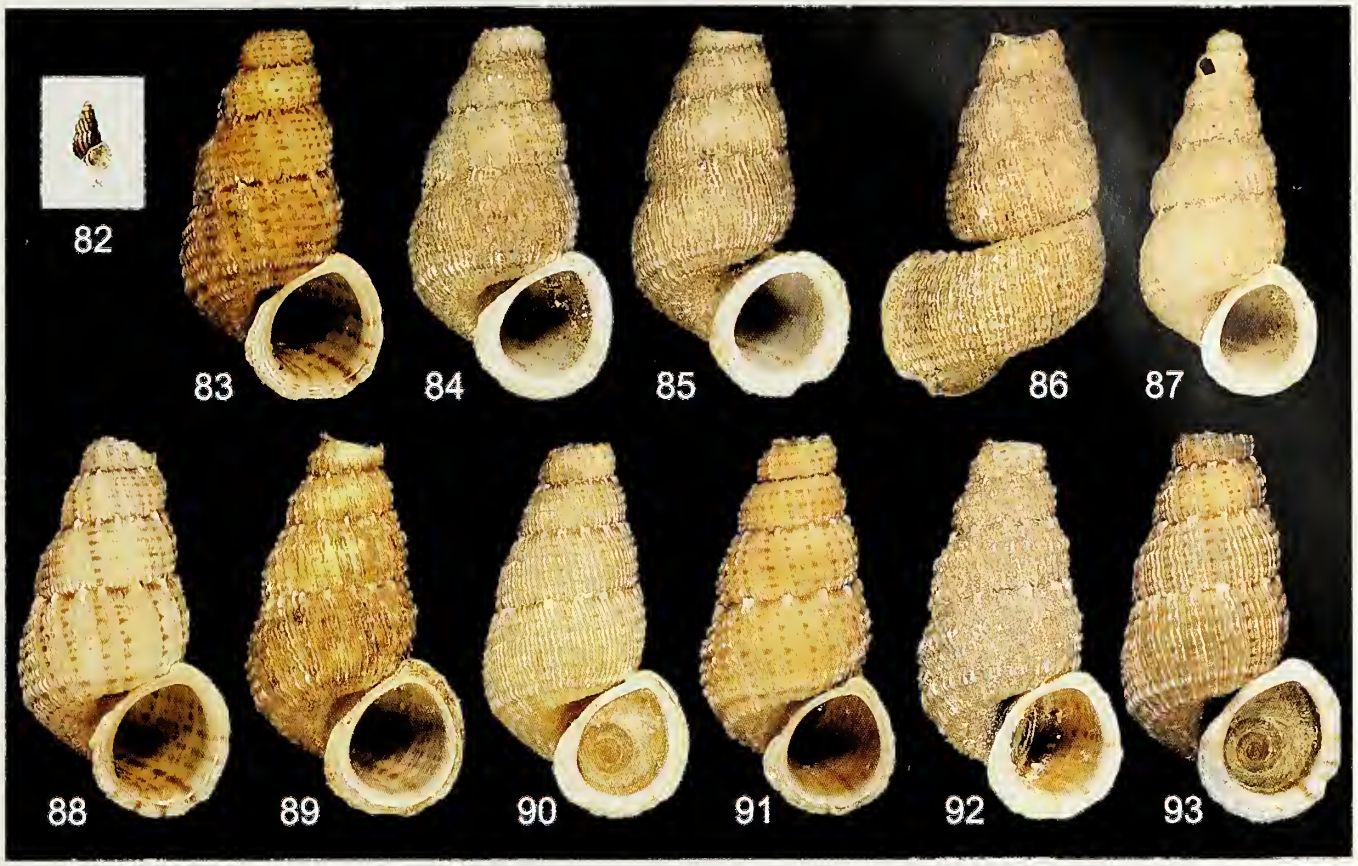
Variation Among Specimens: There was little variation in sculpture in the few specimens seen. The greatest variation was in color, which varied from a base color of tan to white, with or without spiral brown lines.

Comparison with Other Species: This species differs from all other Lesser Antillean annulariids by its small size, feeble sculpture, pale coloration, and lack of sutural tufts.

Original Description (translated from Latin): "Shell subperforated, oblong turret, truncate, solid, with obsolete (rarely distinct) spiral lirae and very dense longitudinal plicate sculpture, opaque, yellowish perhaps whitish, upper smoky, base sometimes lined with some red bands; spire gradually attenuated (lost apex of three obtuse whorls) truncated at top; suture impressed, rather simple; remaining four whorls moderately convex, front of last barely solute, base rounded; aperture subvertical,



Figures 56–81. *Parachondria lineolatus* (Lamarck, 1822). **56–59.** Syntypes of *Cyclostoma lineolata* Lamarck, 1822, MHNG 1093/31, now accessioned as MHNG-INVE-51228. Photos courtesy of Dr. Peter Schuchert (MNHG). **56–57.** ca. 17 mm. **58–59.** ca. 16 mm. **60.** Lectotype of *Cyclostoma newcombianum* Adams, 1849, MCZ 275708. Photo courtesy of A. Baldinger (MCZ), 12.6 mm. **61.** Possible syntype of *Cyclostomus fallax* Pfeiffer, 1851, NHMUK, unnumbered, 17 mm. **62–63.** Probable holotype of *Chondropoma tortolense* Pfeiffer, 1857, ZMB 65673, ca. 15 mm, photos courtesy Christine Zorn, ZMB. **64–65.** *Chondropoma newcombianum* (Adams, 1849) in Reeve, 1863a: pl. 3, figs. 16a, b. **66.** *Chondropoma tortolense* Pfeiffer, 1857, in Reeve, 1863a: pl. 4, fig. 31. **67.** Presumed type figure of *Cyclostomus fallax* Pfeiffer, 1851, from Pfeiffer, 1854d: pl. 45, figs 21. **68–69.** Cinnamon Bay, St. John, GTW 7303b, 13.3 mm. **70.** Zion Hill, Tortola, UF 28691, 13.9 mm; **71.** Great Thatch Island, UF 202918, 17.5 mm. **72.** Guana Island, UF 210990, 14.8 mm. **73.** Tortola, OSUM 36864, 12.9 mm. **74.** Guana Island, UF 183233, 14.4 mm. **75.** Ginger Island, UF 202923, 13.8 mm. **76.** Grand Camanoe Island, UF 210981, 16.8 mm. **77.** Beef Island, UF 28703, 15.4 mm. **78.** Bahia Corcho, Isla de Vieques, UF 193999, 12.3 mm. **79.** Fish Bay Gut, St. John, UF 247114, 16.9 mm. **80.** Calvary Bay, St. John, UF 27958, 13.2 mm. **81.** Anegada, UF 202925, 17.9 mm.



Figures 82–93. *Parachondria* (*Parachondria*) *santacruzensis* (Pfeiffer, 1855). **82.** *Chondropoma santacruzense* (Pfeiffer, 1855), from Reeve, 1863a: pl. 7, fig. 50. **83.** Teague Point, St. Croix, UF 216876, 12.6 mm. **84.** St. Croix, UF 27923, 12.7 mm. **85–86.** St. Croix, UF 27923, 13.0 mm. **87.** St. Croix, UF 27923, 12.2 mm. **88.** Teague Point, St. Croix, UF 216876, 11.8 mm. **89.** Davis Bay, St. Croix, UF 27956, 10.7 mm. **90.** St. Croix, UF 158945, 13.6 mm. **91.** Bellevue, St. Croix, UF 27949, 12.5 mm. **92.** Estate Rattan, St. Croix, UF 426186, 11.7 mm. **93.** Virgin Islands, GTW 7303a, 12.2 mm.

subangulate oval; peristome simple (rarely somewhat double), continuous, everywhere narrowly expanded, upper angle narrowly produced." 12 mm length.

Discussion: None of the specimens examined of this rarely seen species have retained the operculum. Based solely on other shell characteristics, I have placed it in *Chondropoma*. It is not similar to any species from Puerto Rico, Hispaniola, or the Bahamas.

Etymology: Alexis A. Julien (1840–1919), geologist, chemist, natural historian, who studied Sombrero Island.

***Chondropoma* (*Chondropoma*) *pupiforme* (Sowerby, 1843)**
(Figures 11–24, 148–149)

Chresonymy

Cyclostoma pupiforme Sowerby, 1843: 102, pl. 24, figs. 43, 44; Pfeiffer, 1847a: 105; Pfeiffer, 1847c: pl. 14, figs. 15, 16; Pfeiffer, 1848: 121; Petit de la Saussaye, 1850: 46; Watters, 2006: 424–425.

Cyclostoma pupiniformes [*sic*] Sowerby, 1843. —Pfeiffer, 1846a: 43–44.

Cistula pupiformis (Sowerby, 1843). —Gray, 1850: 59–60; Guppy, 1864: 247.

Tudora pupaeformis [*sic*] (Sowerby, 1843). —Pfeiffer, 1851: 167; Pfeiffer, 1852a: 249–250; Pfeiffer, 1852b: 39; Pfeiffer, 1853: 174–175; Pfeiffer, 1858: 127; Bland, 1861: 355; Pfeiffer, 1865: 136; Bland, 1866: 141.

Cistula (*Tudora*) *pupaeformis* [*sic*] (Sowerby, 1843). — Adams and Adams, 1856: 294.

Chondropoma igneum Reeve, 1863b: pl. 11, fig. 88; Pfeiffer, 1865: 149; Pfeiffer, 1876a: 193; Vernhout, 1914: 187; Coomans, 1967: 126; Watters, 2006: 299.

Tudora pupiformis (Sowerby, 1843). —Pfeiffer, 1876a: 183; Kobelt, 1880: 277; Crosse, 1891: 177.

Tudora pupaeformis [*sic*] var. ß (Sowerby, 1843). —Mazé, 1890: 31; Vernhout, 1914: 183, 187.

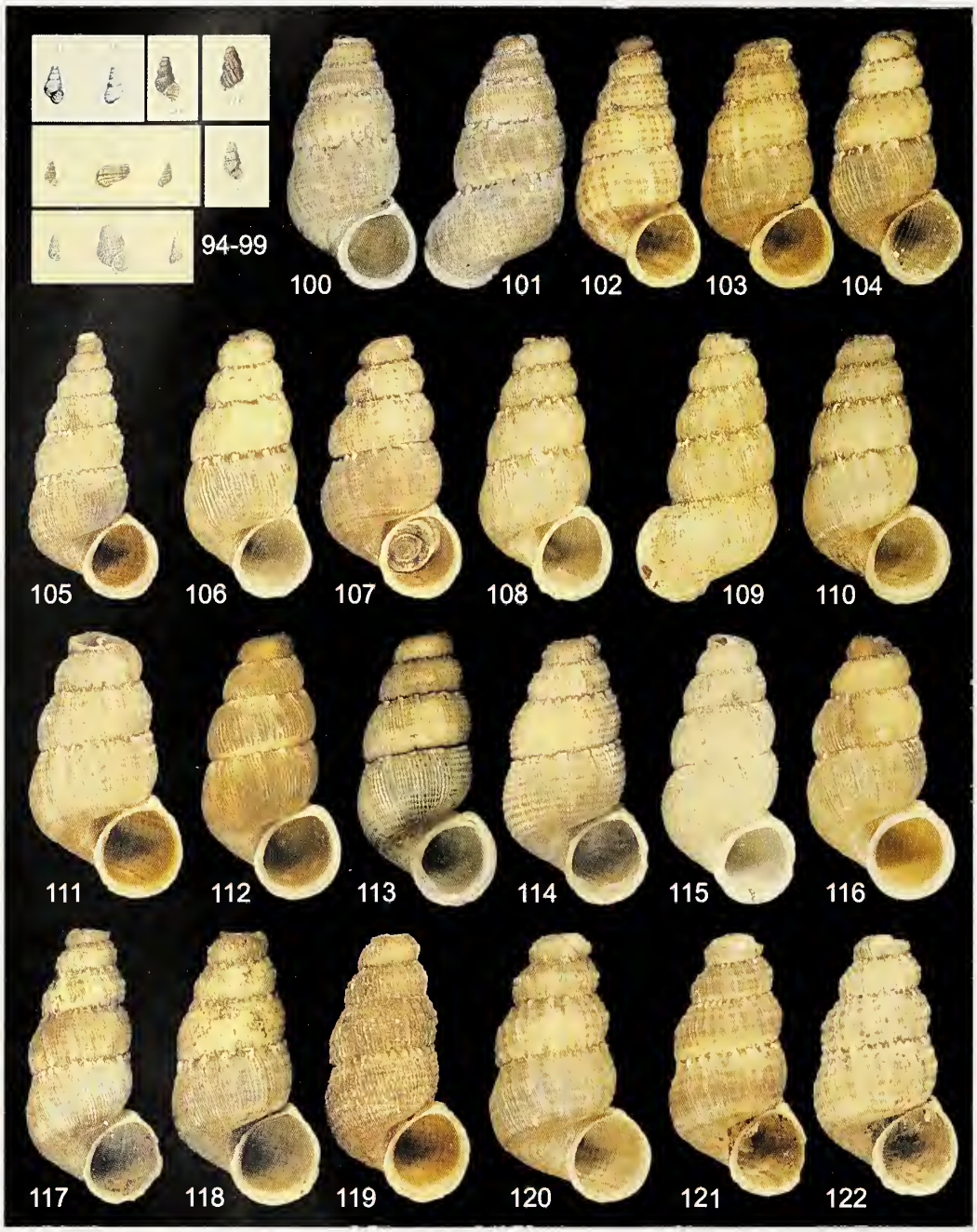
Chondropoma (*Chondropoma*) *ignea* Reeve, 1863. — Henderson and Bartsch, 1921: 62.

Parachondria (*Parachondria*) *pupaeformis* [*sic*] (Sowerby, 1843). — Henderson and Bartsch, 1921: 66; Watters, 2006: 44, 424–425.

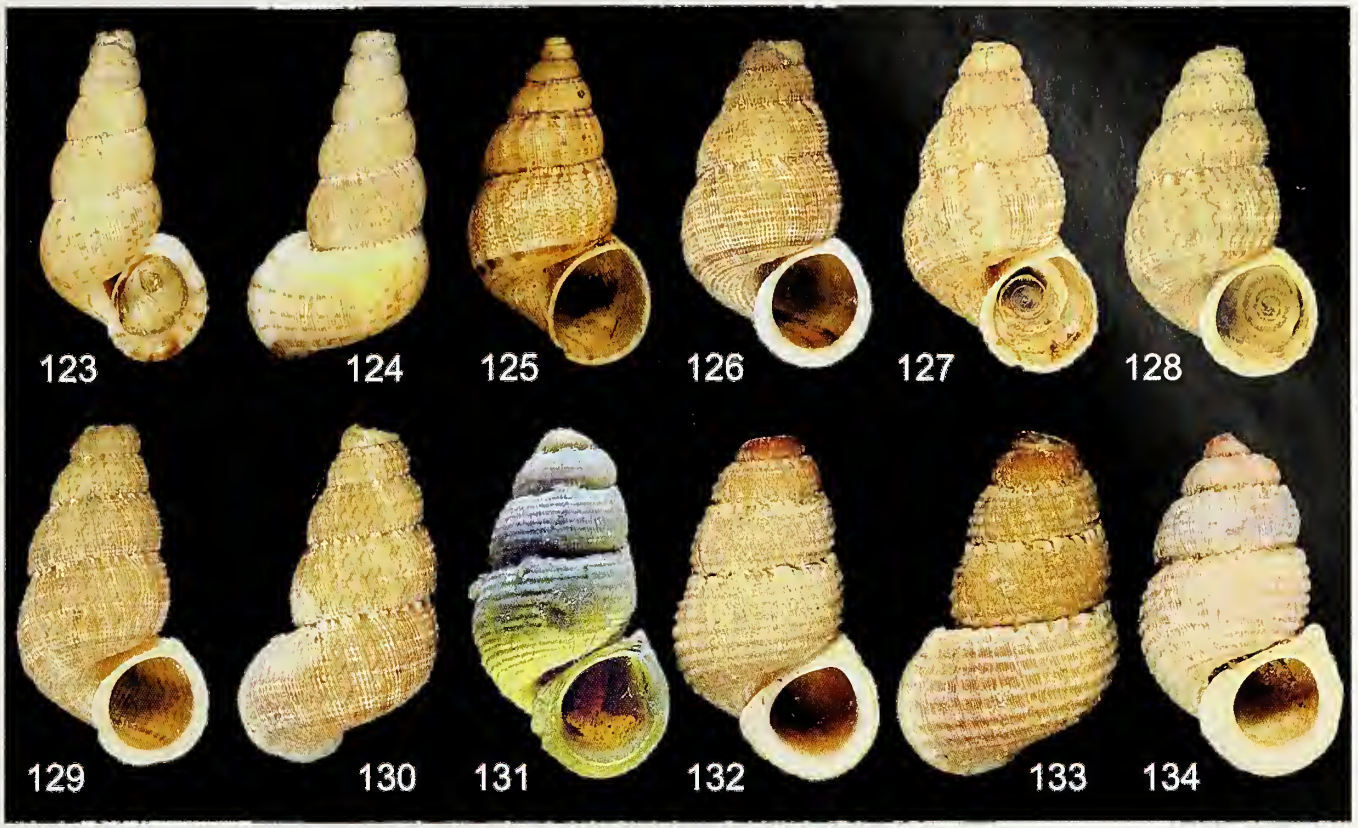
Chondropoma (*Chondropoma*) *pupiforme* (Sowerby, 1843). —Clench and Aguayo, 1937: 66.

Chondropoma (*Chondropomorus*) *ignaeum* Reeve, 1863. —Bartsch, 1946: 199.

Chondropoma (*Chondropomorus*) *pupaeforme* [*sic*] (Sowerby, 1843). —Bartsch, 1946: 199.



Figures 94–122. *Diplopoma crenulatum* (Potiez and Michaud, 1838). **94.** Type figures of *Cyclostoma crenulatum* Potiez and Michaud, 1844, pl. 24, figs. 3, 4. **95.** *Chondropoma guadeloupense* Pfeiffer, 1847, from Reeve, 1863a: pl. 7, figs. 49a, b. **96.** *Chondropoma antiguense* (Pfeiffer, 1858) from Reeve, 1863b: pl. 10, fig. 72. **97.** Presumed type figures of *Chondropoma guadeloupense* Pfeiffer, 1847, from Pfeiffer, 1849: 176, pl. 28, figs. 9–11. **98.** *Chondropoma antiguense* (Pfeiffer, 1858) from Reeve, 1863b: pl. 10, fig. 72. **99.** Type figures of *Choanopoma occidentale* Pfeiffer, 1861: 216, pl. 3, figs. 11–13. **100–101.** Holotype of *Adamsiella* (*Adamsiellops*) *crenulata martinensis* Coomans, 1967, 12.0 mm, photo courtesy of U.S. National Museum of Natural History. **102.** Grands Fonds, Guadeloupe, UF 259784, 10.1 mm. **103.** Morne-à-l'Eau, Guadeloupe, UF 260049, 11.3 mm. **104.** 5 km SE of Grand-Bourg, Marie-Galante, UF 259937, 9.6 mm. **105.** Presqu'Île de la Caravelle, 3 km W of Tartane, Martinique, UF 258449, 13.4 mm. **106.** 3 km NW of Grelin, Marie-Galante, UF 259938, 11.4 mm. **107.** Guadeloupe, UF 216565, 11.3 mm. **108–109.** Presqu'Île de la Caravelle, 3 km W of Tartane, Martinique, UF 258449, 13.1 mm. **110.** Presqu'Île de la Caravelle, 3 km W of Tartane, Martinique, UF 258449, 12.0 mm. **111.** 2.5 km E of Trois-Rivières, Guadeloupe, UF 258460, 8.6 mm. **112.** Rubbish Bay, Barbuda, OSUM 36916, 10.2 mm. **113.** Bull Hole, Barbuda, OSUM 36917, 12.1 mm. **114.** St. Mary Parish, Antigua, OSUM 4155, 10.5 mm. **115.** 9.7 km NNE of St. Johns, Antigua, UF 258450, 12.0. **116.** between Codrington and The Caves, Barbuda, UF 211003, 8.3 mm. **117.** Sainte-Anne, Guadeloupe, GTW 11473a, 11.0 mm. **118.** Le Moule, Guadeloupe, GTW 7064b, 10.5 mm. **119.** Baie de Nord Ouest, 2.5 km W of Le Moule, Guadeloupe, UF 259940, 9.2 mm. **120.** 6 km SE of Anse-Bertrand, Guadeloupe, UF 258455, 9.3 mm. **121.** 3 km NE of Port-Louis, Guadeloupe, UF 258454, 7.8 mm. **122.** 3 km NE of Port-Louis, Guadeloupe, UF 258454, 7.7 mm.



Figures 123–134. *Parachondria* sp. St. Croix, GTW 10099a, 15.9 mm [operculum glued into aperture backwards by collector]. **125.** *Parachondria* cf. *salleanus* (Pfeiffer, 1850). Sombrero Island, UF 119118, 14.3 mm. **126–130.** *Diplopoma decussatum* (Lamarck, 1822). **126.** Monte Pirata, Isle de Vieques, UF 28647, 14.0 mm. **127.** Cayo Luis Peña, UF 23271, 14.0 mm. **128.** Monte Pirata, Isle de Vieques, UF 28668, 13.7 mm. **129–130.** Playa Caracas, Isle de Vieques, UF 28670, 13.6 mm. **131–134.** *Diplopoma sulculosum* (Pfeiffer, 1852). **131.** NHMUK, unnumbered, possible syntype, 15.0 mm. **132–133.** Isaac's Cliff, Blackgarden's Bay, GTW 11473b, 10.7 mm. **134.** E edge of Katouche Bay Valley, UF 48713, 9.6 mm.

Chondropoma pupiforme (Sowerby, 1843). —Clench, 1950: 271.

Chondropoma pupaeformis [*sic*] (Sowerby, 1843). — Coomans, 1967: 126.

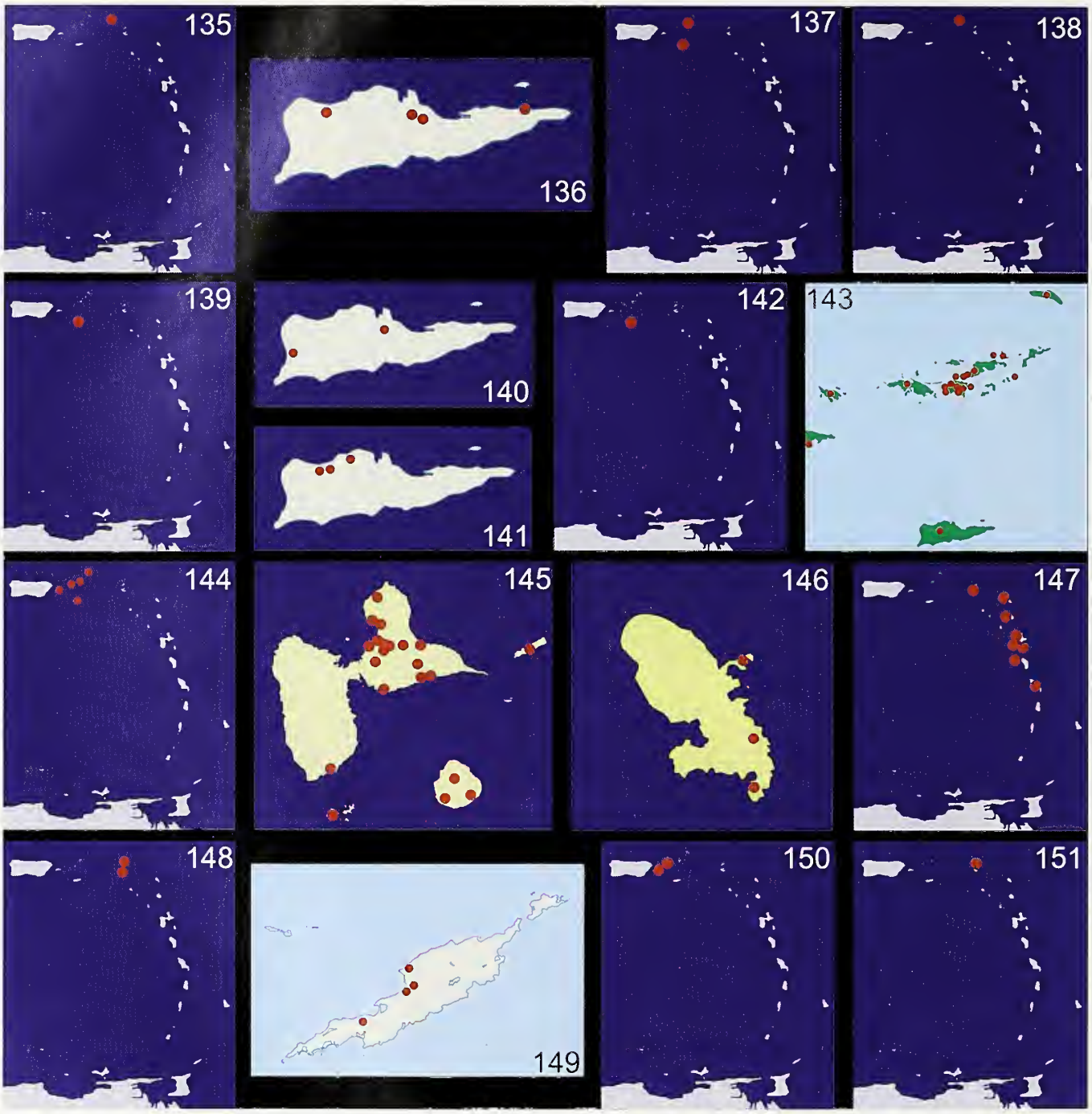
Parachondria (*Parachondria*) *igneus* (Reeve, 1863). — Watters, 2006: 44, 299.

Parachondria (*Parachondria*) *pupiformis* (Sowerby, 1843). —Watters, 2006: 44, 424–425.

Description: Shell medium sized for genus (smallest=8.3 mm, largest=15.8, average=12.0, decollated). Elongate conic to bullet-shaped, whorls solute [not attached to previous whorl] for last 1/8th of last whorl. Umbilicus open but narrow, compressed. Protoconch of 1.5 smooth, rounded, yellowish whorls, rather prominent. 3.5–4.5 decollated whorls remaining; most specimens are decollated. Spiral sculpture of numerous, widely spaced, fine threads or cords (ca. 19 on final whorl). Umbilical cords somewhat stronger than those elsewhere. Axial sculpture of numerous, very fine, closely spaced lamellae, best developed over spiral sculpture where it has a scalloped appearance. Intersections of axial and spiral sculpture form a minute scalloped, almost frosted, sculpture. In a few specimens (Figures 14, 15) scalloped edges appear to have a periostracum that is easily worn away. Suture deeply channeled, bounded by minute sutural tufts. Tufts composed of 1–2 individually, non-fused, expanded axial lamellae, separated by 2–5 non-expanded lamellae, usually forming a regular pattern of tufts/no tufts at suture. Aperture composed of an inner and an outer lip, teardrop-shaped, solute from previous whorl. Inner lip smooth, barely erect from outer lip. Outer lip very narrowly expanded, narrowest toward umbilicus, sharply auriculate, somewhat thickened. Base color of shell pale tan to red or dark brown on final 1–2 whorls. Earliest remaining whorls usually darker. Most specimens patterned with faint, broken, brown spiral bands. Lip white, faintly or not patterned with spiral markings on adapertural side. Interior of aperture tan, orange, or white; spiral markings may show through. Operculum paucispiral with a granulose covering. Radula and anatomy unknown.

Type Material: *Cyclostoma pupiforme* Sowerby, 1843: ?NHMUK – not located; *Chondropoma igneum* Reeve, 1863: ?NHMUK – not located.

Type Localities: *Cyclostoma pupiforme* Sowerby, 1843: Not given; *Chondropoma igneum* Reeve, 1863: Unknown.



Figures 135–151. Distributions. **135.** *Chondropoma julieni* Pfeiffer, 1866, Lesser Antilles. **136–137.** *Parachondria santacruzensis* (Pfeiffer, 1855). **136.** St. Croix. **137.** Lesser Antilles. **138.** *Parachondria* cf. *salleanus* (Pfeiffer, 1850). Lesser Antilles. **139–140.** *Parachondria basicarinatus* (Pfeiffer, 1855). **139.** Lesser Antilles. **140.** St. Croix. **141–142.** *Chondropoma rufilabre* (Potiez and Michaud, 1838). **141.** St. Croix. **142.** Lesser Antilles. **143–144.** *Parachondria lineolatus* (Lamarck, 1822). **143.** Spanish and Virgin islands, St. Croix and Anegada points are generic; **144.** Lesser Antilles. **145–147.** *Diplopoma crenulatum* (Potiez and Michaud, 1838). **145.** Guadeloupe, Marie-Galante, Îles des Saintes, and La Désirade (generic point). **146.** Martinique. **147.** Lesser Antilles. **148–149.** *Chondropoma pupiforme* (Sowerby, 1843). **148.** Lesser Antilles. **149.** Anguilla. **150.** *Diplopoma decussatum* (Lamarck, 1822). Lesser Antilles (also in Puerto Rico). **151.** *Diplopoma sulculosum* (Pfeiffer, 1852). Lesser Antilles.

Type Figures: *Cyclostoma pupiforme* Sowerby, 1843: Sowerby, 1843: pl. 24, figs. 43, 44 (Figure 11); *Chondropoma igneum* Reeve, 1863: Reeve, 1863b: pl. 11, fig. 88 (Figure 12).

Other Material (Specimens Examined: 138): Sint Maarten, OSUM 4129 (2), near Philipsburg; Anguilla, GTW 14639a (2); OSUM 4143 (45); UF 48714 (33), Katouche Bay Valley; UF 48718 (8), E edge of Katouche

Bay Valley; UF 48707 (10), Isaac's Cliff, Blackgarden Bay; UF 48715 (14), Isaac's Cave, Blackgarden Bay; UF 48725 (13), 4 km W of South Hill Village; UF 48727 (11), The Valley [town].

Distribution: Saint Martin/Sint Maartin. Coomans (1967) regarded this species as extirpated from this island. However, fresh specimens collected near Philipsburg in the 1950s (OSUM 4129) suggest this may not be the case. Anguilla. Most records are from the Katouche Bay Valley rain forest on the north-central coast and surrounding areas.

Habitat: In rain forests, probably under rocks and logs. One lot from a cave.

Variation among Specimens: Populations range from dark, un-patterned specimens (Figure 19) to nearly white, almost un-patterned specimens (Figure 24). However, intermediate forms (Figures 20–23) clearly connect the two extremes. Pale specimens occur at Blackgarden Bay and elsewhere and seem to be the form illustrated by Pfeiffer (1847c) as *C. pupiforme* on his plate 14, figures 15 and 16 (Figure 13). The types of *C. pupiforme* and *C. igneum* were based on the dark, un-patterned forms. In other regards, populations vary somewhat in average size. Sculpture is constant.

Comparison with Other Species: The dark brown or red, bicolored forms are unmistakable; the lighter, patterned forms differ in having serrate, non-fused tufts at the suture.

Original Descriptions

Cyclostoma pupiforme Sowerby, 1843: "Shell nearly cylindrical, very slightly acuminated, its apex truncated or decollated; spire consisting of 4 turgid, very finely decussated volutions; suture strongly marked; aperture nearly round, angular at the upper part, peritreme very slightly reflected; umbilicus very small."

Chondropoma igneum Reeve, 1863: "Shell compressly umbilicated, cylindrically conical, rather solid, whitish, tinged with fiery rose, whorls convex, very minutely lamellarly decussated, finely denticulated in the sutures, aperture pyriformly circular, lip scarcely reflected."

Discussion: The type locality of *Cyclostoma pupiforme* Sowerby, 1843, was not given in the original description. Pfeiffer (1848: 121) was uncertain of its origin as well and cautioned: "Remains uncertain. My example is said to come from Mexico, others originate from Haiti" [translated]. Pfeiffer (1852b), Bland (1861), and Henderson and Bartsch (1921) also listed it from Haiti. But Clench and Aguayo (1937: 66) stated "It is questionable whether the species occurs in Hispaniola at all" and Bartsch (1946), in his review of Hispaniolan annulariids, placed it in Saint Martin.

Although *Chondropoma igneum* Reeve, 1863, like *Cyclostoma pupiforme*, was described without locality and the type cannot be located, it seems obvious from the illustration that it is the same species (Figure 12).

Etymology: *Cyclostoma pupiforme* Sowerby, 1843: L. *pupa*, girl or doll, but used in entomological sense of a pupa, L. *forma*, shape; shaped like a pupa; *Chondropoma igneum* Reeve, 1863: L. *ignis*, fire; colored like fire.

***Chondropoma* (*Chondropoma*) *rufilabre* (Potiez and Michaud, 1838)**

(Figures 25–37, 141–142)

Chresonymy

Cyclostoma rufilabrum "Beck, *monente*" Potiez and Michaud, 1838: 241, pl. 24, figs. 20, 21; Mörch, 1854: 10; Pfeiffer, 1855: 101; Watters, 2006: 449–450.

Cyclostoma rufilabrum "Beck." —Sowerby, 1843: 106, pl. 24, fig. 61; Pfeiffer, 1846a: 34; Pfeiffer, 1847a: 106; Pfeiffer, 1852b: 42 [in synonymy of *Cyclostoma bilabre* Menke, 1843]; Pfeiffer, 1853: 188 [in synonymy of *Cyclostoma bilabre* Menke, 1843]; Bland, 1858: 154.

Cyclostoma rufilabre "Michaud." — Petit de la Saussaye, 1850: 46.

Cistula rufilabrum "Beck" Sowerby, 1843. — Gray, 1850: 59.

Cyclostoma bilabre Menke, 1843: 8; Petit de la Saussaye, 1850: 46; Gray, 1850: 59; Pfeiffer, 1855: 101; Bland, 1858: 154; Pfeiffer, 1858: 133; Shuttleworth, 1858: 154; Reeve, 1863b: text to pl. 10; Jacobson, 1968: 21; Watters, 2006: 175 [all, except for Menke, 1843, and Petit, 1850, in synonymy of *Cyclostoma rufilabrum* Potiez and Michaud, 1838].

Cyclostoma rufilabrum "Beck" Sowerby, 1843. —Pfeiffer, 1851: 170 [in possible synonymy of *Cyclostoma bilabre* Menke, 1843]; Pfeiffer, 1852a: 268 [in synonymy of *Cyclostoma bilabre* Menke, 1843].

Cistula bilabre (Menke, 1843). —Pfeiffer, 1853: 188 [in synonymy of *Cyclostoma rufilabrum* Potiez and Michaud, 1838].

Cistula rufilabris ("Beck"). —Pfeiffer, 1851: 170; Pfeiffer, 1852a: 268; Pfeiffer, 1858: 133; Bland, 1861: 359; Pfeiffer, 1865: 143; Pfeiffer, 1876a: 188; Kobelt, 1880: 281; Hinkley, 1885: 21.

Cistula ? bilabris (Menke, 1843). —Pfeiffer, 1852b: 42.

Cistula bilabris (Menke, 1843). —Pfeiffer, 1853: 188; Adams and Adams, 1856: 293.

Tudora rufilabrum ("Beck"). —Mörch, 1860: 12.

Chondropoma rufilabre ("Beck"). —Reeve, 1863b: pl. 10, figs. 73a, b.

Chondropoma (*Chondropoma*) *rufilabre* ("Beck" Potiez and Michaud, 1838). —Henderson and Bartsch, 1921: 62; Watters, 2006: 28, 449–450.

Cistula rufilabris ("Pfeiffer"). —Baker, 1956: 31.

Chondropoma rufilabrum ("Beck" Potiez and Michaud, 1838). — Jacobson, 1968: 21.

non Cyclostoma bilabre "Menke" Pfeiffer, 1846b: pl. 6, figs. 22, 23 *fide* Pfeiffer, 1847d: 52 [= ?].

Description: Shell small-medium sized for genus (smallest=6 mm, largest= 13.8, average=10.8, decollated). Short, compact, bullet-shaped, whorls adnate. Umbilicus closed or nearly so by outer lip. Protoconch of 1.5 smooth, inflated whorls, barely demarcated from teleoconch. 3.5–4.5 decollated whorls, most specimens are decollated. Spiral sculpture of numerous, widely spaced, rounded cords (ca. 15–19 on final whorl). Umbilical cords somewhat stronger than those elsewhere. Axial sculpture of numerous, very fine, closely spaced lamellae, best developed over spiral sculpture where it has a scalloped or granulose appearance; slightly stronger at suture in some specimens. Suture narrowly channeled or sealed, rendered serrate by axial sculpture; tufts absent. Aperture composed of an inner and an outer lip, oval, adnate to previous whorl. Inner lip smooth, erect from outer lip, thickened. Outer lip expanded, narrowest toward umbilicus, auriculate at 12 and 7 o'clock positions, thickened, composed of numerous lamellae, edge slightly scalloped. Base color of shell pale tan to straw-colored. Occasional pale specimens patterned with faint, broken or continuous, brown spiral bands (Figure 31) but most specimens un-patterned. Lip yellow, orange, red, or dark purple, inner lip often more darkly colored than outer lip. Interior of aperture orange or tan, colored at margin with color of lip. Operculum paucispiral with a granulose covering. Radula and anatomy unknown. Rarely specimens seem to have a remnant of a periostracum (Figure 36).

Type Material: *Cyclostoma rufilabrum* Potiez and Michaud, 1838: Douai Museum. According to the website of the Musée de la Chartreuse Douai, the "natural sciences collection [was] completely destroyed" during WW II; specimens also in the Férussac collection were subsequently incorporated into the general collection of the Muséum national d'Histoire naturelle, Paris (Dance, 1966); *Cyclostoma bilabre* Menke, 1843: Menke collection dispersed (Kohn, 1992).

Type Localities: *Cyclostoma rufilabrum* Potiez and Michaud, 1838: "Les Indes? les Antilles" [Orient, *fide* Gray (1850). St. Croix, *fide* Sowerby (1843) and Bland (1861). St. Croix and St. Thomas, *fide* Shuttleworth (1858)]; *Cyclostoma bilabre* Menke, 1843: "*in ora orientali*" [Ostküste von Neuholland, *fide* Pfeiffer (1846b). Orient, *fide* Gray (1850). Corrected to Virgin Islands, Menke in Shuttleworth (1858)].

Type Figures: *Cyclostoma rufilabrum* Potiez and Michaud, 1838: pl. 24, figs. 20, 21 (Figures 25, 26); *Cyclostoma bilabre* Menke, 1843: Unfigured.

Other Material (Specimens Examined: 583): U.S. Virgin Islands, OSUM 22088 (2); OSUM 36198 (3); St. Croix, GTW 8270a (1); OSUM 36197 (7); OSUM 36212 (2); OSUM 36213 (2); UF 7597 (131); UF 18317 (1); UF 118887 (50); UF 158946 (6); UF 195527 (2); UF 195528 (7); UF 216802 (3); UF 216803 (6); GTW 8270b (1), north shore; UF 27954 (33), North Star; UF 27957 (43), Davis Bay; UF 27962a,b (283), Rust op Twist.

Distribution: U.S. Virgin Islands: This species is probably endemic to St. Croix. Shuttleworth (1858) listed St. Thomas for *C. bilabre* Menke, 1843, but I have not seen any specimens from there and given the uncertainty of that taxon the record is regarded as questionable. The majority of lots are labeled only "St. Croix" without further information. The few localized lots are from a 6 km expanse on the northern coast from Davis Bay to Rust op Twist, but the actual extent of the species on the island is unknown.

Habitat: No habitat information found but apparently limited to the hills on the north side of the island, where it is locally abundant.

Variation among Specimens: Populations vary in the number of spiral cords (15–19) and color of the aperture and lip but generally are quite uniform in other shell characteristics.

Comparison with Other Species: No other annulariid, in the Lesser Antilles or elsewhere, has the combination of a small, compact shell, uniformly decussate sculpture, and (usually) brightly colored aperture and peristome. It most closely resembles *Chondropoma schalei* Baker, 1950, from Puerto Rico, with which it may have a common ancestor.

Original Descriptions

Cyclostoma rufilabrum Potiez and Michaud, 1838 (translated from French): "Shell oval-conic, perforated or subperforated, yellowish-white and latticed; spire composed of four convex whorls; suture fairly well indicated, especially in the variety A; lip reddish, but the same color as in the cavity of the shell; aperture oblique ovoid; summit truncated. We do not know the operculum." Variety A "larger, perforated, lacking striae, suture deep, lip yellow-white."

Cyclostoma bilabre Menke, 1843 (translated from Latin): "Shell ovate-conic, apex decollated, imperforate, solid; five convex whorls, sides with a longitudinally traverse, dense, elegant weave; peristome double: externally reflexed."

Discussion: *Cyclostoma bilabre* Menke, 1843, has been considered a junior synonym of *C. rufilabrum* by most authors, despite a lack of illustration or adequate original description (which makes no reference to the distinctly colored peristome of this species). There is no indication that any subsequent author had seen the type specimen or series. Given that the type is apparently lost and was never illustrated, and the species cannot be identified from the original description, it is best to consider this taxon a *nomen dubium*.

Etymology: *Cyclostoma rufilabrum* Potiez and Michaud, 1838: L. *rufus*, red + L. *labrum*, lip; red lipped;

Cyclostoma bilabre Menke, 1843: L. *bi*, two + L. *labrum*, lip; two lipped.

Genus *Parachondria* Dall, 1905
Subgenus *Parachondria* Dall, 1905

Type Species: *Turbo fascia* Wood, 1828, by original designation.

***Parachondria* (*Parachondria*) *basicarinatus* (Pfeiffer, 1855)**
(Figures 38–55, 139–140)

Chresonymy

Cyclostoma basicarinatum Pfeiffer, 1855: 101–102, pl. 4, figs. 2, 3; Weinland, 1876: 174; Pfeiffer, 1876b: 234; Weinland, 1880: 349.
Cyclostoma chordiferum Pfeiffer, 1855: 102, pl. 4, fig. 1; Weinland, 1876: 174; Weinland, 1880: 349; Watters, 2006: 204–205.
Chondropoma basicarinatum (Pfeiffer, 1855). —Mörch, 1860: 12; Jacobson, 1968: 20 [in synonymy of *Cyclostoma santacruzense* Pfeiffer, 1855].
Cyclostomus chordiferum Pfeiffer, 1855. —Bland, 1861: 361; Bland, 1866: 139.
? *Chondropoma basicarinatum* (Pfeiffer, 1855). —Reeve, 1863a: pl. 8, fig. 58.
Chondropoma (*Chondropomorus*) *basicarinatum* (Pfeiffer, 1855). —Henderson and Bartsch, 1921: 61.
Chondropoma chordiferum (Pfeiffer, 1855). —Jacobson, 1968: 20 [in synonymy of *Cyclostoma santacruzense* Pfeiffer, 1855).
Parachondria (*Parachondria*) *basicarinatus* (Pfeiffer, 1855). —Watters, 2006: 44, 166.
Parachondria (*Parachondria*) *chordiferus* (Pfeiffer, 1855). —Watters, 2006: 44, 204–205.

Description: Shell large for genus (smallest=16.4 mm, largest=23.0, average=19.3, decollated). Elongate conic, whorls rarely adnate, more commonly solute for last ¼ of last whorl. Umbilicus open, narrow. Protoconch lost in all examples seen. 4.5–4.75 decollated remaining whorls. Spiral sculpture of numerous, closely spaced threads (ca. 17–19 on final whorl). Those within umbilicus and just before it are much stronger and more widely separated, forming a basal carinae in some specimens. Axial sculpture of numerous, very fine, closely spaced lamellae, best developed over spiral sculpture where it has a scalloped appearance; slightly stronger on basal cords. Intersections of axial and spiral sculpture form a minute scalloped sculpture. Suture deeply channeled to sealed, rendered serrate by tufts. Tufts of 2–4 barely fused, expanded axial lamellae separated by 1–8 unfused lamellae. Aperture composed of an inner and an outer lip, teardrop-shaped, solute from previous whorl. Inner lip smooth, erect laterally and anteriorly from outer lip. Outer lip narrowly expanded, narrowest toward umbilicus, auriculate at 12 and 7 o'clock positions, thickened, composed of numerous lamellae, anterior-medial edge scalloped. All examples seen are faded, heavily weathered specimens. Specimens patterned with broken, brown spiral bands that form a regular checkerboard pattern. Lip and aperture color unknown. Operculum, radula, and anatomy unknown.

Type Material: *Cyclostoma basicarinatum* Pfeiffer, 1855: Three specimens, ZMB 96810(1)-96810(3), from the Dunker collection might represent Pfeiffer's material and are labeled "*Choanopoma basicarinatum* Pfr." (Figures 41–45). Although clearly the same species, none closely match Pfeiffer's 1855 plate 4, figures 2 and 3 of *Cyclostoma basicarinatum*, presumably the figured type. They probably are syntypes but this cannot be shown with certainty. Additionally, Pfeiffer's material was not located by me at NHMUK in 2004; *Cyclostoma chordiferum* Pfeiffer, 1855: Two specimens at ZMB, with an original number of 1231(1), 1231(2) from Pfeiffer's collection, are only labeled with "St. Croix" with no mention of "Bülows Minde" (Figures 47–50). Neither closely matches the presumed type figure. Although Pfeiffer clearly had more than one specimen (he gave a range of sizes), none at the ZMB can be associated with the type lot with certainty although they probably are syntypes. Additionally, Pfeiffer's material was not located by me at NHMUK in 2004.

Type Localities: *Cyclostoma basicarinatum* Pfeiffer, 1855: "*La Grange prope Frederiksted insulae St. Croix*"; *Cyclostoma chordiferum* Pfeiffer, 1855: "'*Bülows Minde*' *insulae St. Croix.*"

Type Figures: *Cyclostoma basicarinatum* Pfeiffer, 1855: Pfeiffer, 1855: pl. 4, figs. 2, 3 (Figures 38–39); *Cyclostoma chordiferum* Pfeiffer, 1855: Pfeiffer, 1855: pl. 4, fig. 1 (Figure 46).

Other Material (Specimens Examined: 14): U.S. Virgin Islands, St. Croix, UF 18318 (2), UF 27922 (2), UF 27927 (3), UF 195459 (2); UF 27885 (2), Bellevue; UF 27890 (3), Frederiksted.

Distribution: U.S. Virgin Islands: This species is endemic to St. Croix, where it is possibly extinct. Specimens, including the type, have been recorded from Frederiksted on the west coast and Bellevue/Bulows Minde just west of Christiansted.

Habitat: Unknown. The type locality of *C. basicarinatum*, near Frederiksted, is adjacent to a remnant patch of rain forest and it is likely that this species once occurred in similar habitat across the island. All of the known sites for this species are in hill country.

Variation Among Specimens: Specimens vary in the strength of spiral sculpture and degree of separation of the outer lip from the previous whorl.

Comparison with Other Species: *Parachondria basicarinatus* is very similar to the extant *P. santacruzensis*. They differ primarily in size: *P. basicarinatus* averages 19.3 mm in length, *P. santacruzensis* averages 12.2 mm.

Parachondria basicarinatus has more spiral threads on the final whorl (17–19) than does *P. santacruzensis* (12–15).

Original Descriptions

Cyclostoma basicarinatum Pfeiffer, 1855 (translated from Latin): "Shell barely perforated, oblong turret, truncate, spiral lirae, sculpture densely ribbed, somewhat interrupted (3–4 bundles formed), discolored, faint interrupted brown bands evident; spire rather regularly attenuated; suture densely denticulated; remaining five whorls slightly convex, front of last barely solute, base with 2–3 strong, well-developed carinae; aperture subvertical, angulate oval; peristome double: inner barely expanded, external expanded, upper and left margin narrow." 18–19 mm length.

Cyclostoma chordiferum Pfeiffer, 1855 (translated from Latin): "Shell very narrowly perforated, oblong-turret, truncate, obsolete spiral lirae and crowded ribs, discolored; spire rather regularly attenuated; suture with crowded denticles; 4.5 remaining whorls, slightly convex, front of last briefly solute, base with 6–7 elevated, strong lirae; aperture angulate-oval; peristome double: inner expanded, barely projecting, outer subequally expanded everywhere." 19–23 mm length.

Discussion: Both *C. basicarinatum* and its synonymous taxon *C. chordiferum* were described from heavily weathered specimens. Reeve's figured specimen, collected by 1863, appears recent (Figure 40). However, this figure may actually represent the extant *P. santacruzensis*, but it is not sufficiently detailed to determine to which taxon it applies and Reeve does not indicate its size. No more recent specimens are known.

Although no examples retain an operculum, the close similarity of this species with *Parachondria santacruzensis* indicates that it is a *Parachondria* as well.

Etymology: *Cyclostoma basicarinatum* Pfeiffer, 1855: L. *basis*, base + L. *carina*, keel; keeled on the base; *Cyclostoma chordiferum* Pfeiffer, 1855: L. *chorda*, cord + L. *–fer*, carry; bearing cords.

Parachondria (*Parachondria*) *lineolatus* (Lamarck, 1822) (Figure 56–81, 143–144)

Chresonymy

Cyclostoma lineolata Lamarck, 1822: 147; Deshayes and Milne Edwards, 1838: 358–359; Delessert, 1841: pl. 29, figs. 8a,b,c; Pfeiffer, 1852a: 418; Shuttleworth, 1854b: 91; Mermod, 1952: 49–51, figs. 114a–c; Watters, 2006: 335.

Cyclostoma lineolatum Lamarck, 1822. —Pfeiffer, 1847a: 105; Petit de la Saussaye, 1850: 46.

Cyclostoma swiftianum "Newcomb MMS, 1845" Adams, 1849a: 8 [*nomen nudum*].

Cyclostoma newcombianum Adams, 1849a: 8; Adams, 1849b: 15; Adams, 1851a: 2; Adams and Chitty, 1851a: 177; Adams and Chitty, 1851b: 101; Adams, 1851b: 180; Adams, 1854: 104; Adams, 1851c: 203; Bland, 1852: 216; Bland, 1854: 74; Pfeiffer, 1854c: 278, pl. 37, figs. 25, 26; Jacobson and Boss, 1973: 390–391, pl. 59, fig. 1; Watters, 2006: 372.

Cyclostoma troscheli Pfeiffer, 1850a: 64; Pfeiffer, 1851: 173 [in synonymy of *Cyclostoma newcombianum* Adams, 1849]; Adams, 1851c: 203; Pfeiffer, 1852a: 288–289 [in synonymy of *Cyclostoma newcombianum* Adams, 1849]; Bland, 1852: 216 [in synonymy of *Cyclostoma newcombianum* Adams, 1849]; Pfeiffer, 1852b: 45 [in synonymy of *Cyclostoma newcombianum* Adams, 1849]; Reeve, 1863a: text to pl. 3 [in synonymy of *Cyclostoma newcombianum* Adams, 1849]; Arango y Molina, 1865: 89; Arango y Molina, 1867: 76; Arango y Molina, 1878: 11 [as Pfeiffer, 1864]; Kobelt, 1880: 261; Jacobson and Boss, 1973: 390–391; Watters, 2006: 521—522.

Cistula lineolata (Lamarck, 1822). —Gray, 1850: 58; Adams and Adams, 1856: 294; Pfeiffer, 1858: 134; Bland, 1861: 358; Pfeiffer, 1862: 154; Pfeiffer, 1876a: 188; Gundlach, 1878: 14–15; Crosse, 1891: 169; Dall and Simpson, 1901: 435.

Cistula? lineolata (Lamarck, 1822). —Pfeiffer, 1851: 170; Pfeiffer, 1852a: 270, 418; Pfeiffer, 1852b: 42; Pfeiffer, 1853: 188–189.

Cyclostomus fallax Pfeiffer, 1851: 171 [*nomen nudum*]; Pfeiffer, 1852c: 68; Pfeiffer, 1858: 126; Bland, 1861: 359; Pfeiffer, 1865: 134; Pfeiffer, 1876a: 182; Kobelt, 1880: 281; Watters, 2006: 260.

Chondropoma newcombianum (Adams, 1849). —Pfeiffer, 1851: 173; Pfeiffer, 1852a: 288–289; Pfeiffer, 1852b: 45; Adams and Adams, 1856: 295; Pfeiffer, 1857: 158; Bland, 1861: 358–359, table 2; Reeve, 1863a: pl. 3, figs. 16a, b; Pfeiffer, 1865: 152; Pfeiffer, 1876a: 194; Gundlach, 1878: 15–16; Kobelt, 1879: 198, pl. 62, fig. 39; Kobelt, 1880: 279, 281; Fischer and Crosse, 1890: 203.

Chondropoma swiftianum "Newcomb" Pfeiffer, 1851: 173 [introduced in synonymy of *Cyclostoma newcombianum* Adams, 1849]; Pfeiffer, 1852a: 288–289 [in synonymy of *Cyclostoma newcombianum* Adams, 1849]; Bland, 1852: 216 [in synonymy of *Cyclostoma newcombianum* Adams, 1849]; Pfeiffer, 1852b: 45 [in synonymy of *Cyclostoma newcombianum* Adams, 1849]; Reeve, 1863a: text to pl. 3 [in synonymy of *Cyclostoma newcombianum* Adams, 1849].

Cistula? fallax (Pfeiffer, 1852). —Pfeiffer, 1852a: 273; Pfeiffer, 1853: 192–193.

Cistula fallax (Pfeiffer, 1852). —Pfeiffer, 1852b: 43; Adams and Adams, 1856: 294.

Cyclostoma (*Cistula?*) *fallax* (Pfeiffer, 1852). —Pfeiffer, 1854a: 65–66.

Cyclostoma fallax (Pfeiffer, 1852). —Pfeiffer, 1854d: pl. 45, figs. 21, 22; Pfeiffer, 1854e: 369; Reeve, 1861b: pl. 12, fig. 71.

Cyclostoma (*Chondropoma*) *newcombianum* Adams, 1849. Shuttleworth, 1854a: 71.

Cyclostoma (*Chondropoma?*) *newcombianum* Adams, 1849. Shuttleworth, 1854b: 92.

Chondropoma tortolense Pfeiffer, 1857: 158; Bland, 1861: 359; Reeve, 1863a: pl. 4, fig. 31; Pfeiffer, 1865: 152; Pfeiffer, 1876a: 195; Kobelt, 1880: 281; Martens, 1882: 370–371; Clench, 1939: 288; van der Schalie, 1948: 35; Watters, 2006: 516.

Chondropoma lineolatum (Lamarck, 1822). —Mörch, 1860: 12.

Cistula lineolata ("Pfeiffer"). —Kobelt, 1880: 279.

Chondropoma (*Chondropomorus*) *newcombianum* (Adams, 1849). —Henderson and Bartsch, 1921: 61.

Chondropoma (*Chondropomorus*) *tortolense* Pfeiffer, 1857. —Henderson and Bartsch, 1921: 61.

Cyclostoma lineatum [sic] Lamarck, 1822. —Mermod, 1952: 50.

Licina decussata "Lamarck" Parkinson, 1987: 62, fig. 53, bottom middle [misidentification].

Parachondria (*Parachondria*) *fallax* (Pfeiffer, 1852). —Watters, 2006: 44, 260.

Parachondria (*Parachondria*) *lineolatus* (Lamarck, 1822). —Watters, 2006: 44, 335.

Parachondria (*Paracondria*) *newcombianus* (Adams, 1849). —Watters, 2006: 44, 372.

Parachondria (*Parachondria*) *tortolensis* (Pfeiffer, 1857). —Watters, 2006: 44, 516.

non Choanopoma troscheli Pfeiffer, 1864. —Watters, 2006: 522 [in synonymy of *Cyclostoma newcombianum* Adams, 1849, in error].

non Cyclostoma lineolatum "Lamarck" Pfeiffer, 1847d: 49, pl. 6, figs. 27, 28 [pl. 1846]; [= ?; *fide* Mermod, 1952: 50].

Description: Shell medium-sized for genus (smallest= 10.1 mm, largest=17.5, average=14.2, decollated). Elongate conic, last whorl nearly adnate to openly solute for last ¼ turn. Umbilicus open, narrow. Protoconch of 1.5 rounded, smooth whorls. 3.5–5 decollated remaining whorls. Spiral sculpture of numerous threads (ca. 27–30 on final whorl). Threads widely separated below suture but become less so as they progress toward umbilicus. Axial sculpture of numerous, very fine, closely spaced lamellae, best developed over spiral sculpture where it has a scalloped or slightly fenestrate appearance. In addition, some specimens have very regular, peculiar, raised axial ridges reminiscent of "varices" that divide whorl into axial sections. Suture deeply channeled, bounded by very regularly spaced, well-developed tufts. Tufts composed of 2–5 fused or barely fused axial lamellae; tufts begin just after raised axial ridges and individual lamellae within tuft decrease in height as shell enlarges. Aperture composed of an inner and an outer lip, oval to teardrop-shaped, solute from previous whorl. Inner lip smooth, inconspicuous. Outer lip narrowly expanded, narrowest toward umbilicus, auriculate posteriorly, thickened, composed of numerous lamellae, anterior-medial edge scalloped in some specimens. Base color pale tan to reddish brown overlain with a complex color pattern. Dark brown axial markings may be solid scallops (Figure 74), undulating lines (Figure 75), broken diagonal lines (Figure 72), or absent (Figure 77). Dark spiral bands may be present on base. Tufts and intersections of axial and spiral sculpture may be white. Lip white, rarely banded. Outer color pattern may show through within aperture. Operculum paucispiral with a granulose deposit. Radula and anatomy unknown.

Type Material: *Cyclostoma lineolata* Lamarck, 1822: Syntypes: MHNG 1093/31 (11), now accessioned as MHNG-INVE-51228 (Figures 56–59); *Cyclostoma newcombianum* Adams, 1849: Lectotype: MCZ 275708, by subsequent designation of Jacobson and Boss (1973) (Figure 60); ? Paralectotype: SMF unnumbered; *Cyclostoma troscheli* Pfeiffer, 1850: Not located and presumed lost; *Cyclostomus fallax* Pfeiffer, 1851: Three specimens at NHMUK, unnumbered, from the Cuming collection bearing Pfeiffer's handwriting may be syntypes (Figure 61); *Chondropoma tortolense* Pfeiffer, 1857: One specimen, ZMB 65673, from the Pfeiffer collection, collected at Tortola by Riise, matches the description and size of the specimen in Pfeiffer's original description (Figures 62–63). Pfeiffer described the operculum, which is also present in the ZMB specimen. I regard this ZMB specimen as the holotype.

Type Localities: *Cyclostoma lineolata* Lamarck, 1822: "dans les Antilles." Restricted here to St. John, U.S. Virgin Islands [see remarks]; *Cyclostoma newcombianum* Adams, 1849: "Jamaica." Originally believed to be from Jamaica, but later corrected to St. Thomas by Adams and Chitty (1851a); *Cyclostoma troscheli* Pfeiffer, 1850: "*in ins. St. Thomas*"; *Cyclostomus fallax* Pfeiffer, 1851: "hab.?"; *Chondropoma tortolense* Pfeiffer, 1857: "*in insulae Tortola*" collected by Riise.

Type Figures: *Cyclostoma lineolata* Lamarck, 1822: Mermod, 1952: figs. 114a,b,c; *Cyclostoma newcombianum* Adams, 1849: Jacobson and Boss, 1973: pl. 59, fig. 1; *Cyclostoma troscheli* Pfeiffer, 1850: Unfigured; *Cyclostomus fallax* Pfeiffer, 1851: Pfeiffer, 1854d: pl. 45, figs. 21, 22 (Figure 67); *Chondropoma tortolense* Pfeiffer, 1857: Unfigured.

Other Material (Specimens Examined: 325): Spanish Virgin Islands, Isla Culebra, UF 23261 (1), S slope Cerro Resaca; UF 23250 (6), UF 23252 (1), Cerro Resaca. Isla de Vieques, UF 28670 (9), UF 193999 (3), Playa Caracas, Fort Garcia; UF 28647 (11), UF 28668 (10), Monte Pirata, near summit. British Virgin Islands, Anegada, UF 202925 (7). Beef Island, UF 28703 (2). Ginger Island. UF 202923 (3). Grand Camanoe Island. UF 210981 (18). Guana Island. UF 183244 (1), UF 210990 (11); UF 210993 (5), ridge along NE end. Great Thatch Island, UF 202918 (4), UF 202919 (7). Tortola, UF 119182 (2); OSUM 36864 (5), GTW 7063a (1), 488 m, Sage Mountain; UF 27947 (2), UF 28696 (1), UF 28699 (5), Sage Mountain; UF 28676 (16), UF 28683 (11), UF 28691 (15), Zion Hill; UF 183244 (1), West End, Belmont Pond. U.S. Virgin Islands. St. Croix. GTW 10099b (1). St. John, UF 259948 (3); UF 27975 (13), Bordeaux Mountain; UF 48872 (1), Calabash Bay; UF 27958 (2), Calvary Bay; UF

197916 (4), Caneel Bay; UF 197923 (1), Catherineberg Sugar Mill; UF 27963 (2), Chocolate Hole; GTW 7303b (3), UF 27979 (28), along Cinnamon Bay Trail, Cinnamon Bay; UF 48862 (1), Butler's Gut, Coral Bay; UF 48759 (1), Coral Bay; UF 247114 (2), UF 247115 (2), Fish Bay Gut; UF 197945 (18), Josie Gut Sugar Estate ruins; UF 247126 (1), Great Lameshur Bay; UF 27968 (28), UF 247135 (2), UF 247136 (2), Reef Bay; UF 27980 (74), Wahoe Bay; UF 48851 (1), UF 259947 (2), Windberg Gut. St. Thomas. UF 119180 (1), UF 119181 (2), UF 119183 (5), UF 216686 (1), UF 216687 (2); UF 113836 (1), W slope of mountain top, N of intersection of hwys. 33/40.

Distribution: Isla Culebra, Isla de Vieques, British and U.S. Virgin Islands. Pfeiffer (1851) reported *Cyclostoma lineolata* from St. Vincent but Mermod (1952) could not verify this locality. It is highly unlikely that this record is correct; no annulariids are known from St. Vincent.

Habitat: Under rocks, logs.

Variation among Specimens: As may be expected from a widespread species occurring on isolated islands, there is significant variation. Color patterns vary greatly but all have the same common elements and intermediates occur for any two extremes. Sculpture varies from scalloped to fenestrate depending on the strength of the axial lamellae. The degree of "soluteness" of the outer lip also varies, from the very solute form characterized by *Cyclostomus fallax* Pfeiffer, 1851, to the nearly adnate *Cyclostoma lineolata* Lamarck, 1822. The types of *Cyclostoma lineolata* Lamarck, 1822, are unusual in retaining the protoconch.

Comparison with Other Species: The distinct and regular color pattern and tufts of this species separate it from most other Lesser Antillean taxa. The raised axial ridges ("varices") of some specimens are unique.

Diplopoma decussatum, with which this species co-occurs in the Spanish Virgin Islands, is easily discerned by its operculum (multispiral and lamellate in *D. decussatum* and paucispiral without a lamella in *P. lineolatus*). However, lacking the operculum the two are nearly inseparable based solely on shell characteristics. *Diplopoma decussatum* never has the "varices" of *P. lineolatus* and the individual lamella of each sutural tuft do not decrease in size within the tuft. Nevertheless specimens may be very difficult to separate (e.g., the probable holotype of *Chondropoma tortolense* Pfeiffer, 1857, (Figures 62, 63) would have been assigned to *D. decussatum* if not for the operculum).

Original Descriptions

Cyclostoma lineolata Lamarck, 1822 (translated from Latin): "Shell ventricose-conic, somewhat perforated, with thin longitudinal striations, yellowish-brown, banded with interrupted white lines; with wavy longitudinal reddish-brown little lines; seven remaining, convex; margin of lip white, reflexed."

Cyclostoma newcombianum Adams, 1849: "Shell much elongated, conic; very pale orange, elegantly decorated with several spiral series of small brown oblique spots which have white shadows, the spots being in transverse series; with numerous small but strong transverse whitish raised lines, which are mostly in groups of three to five and at the summits are developed into minute sutural crenulations; spire with slightly convex outlines; apex truncate with the loss of two or three whorls; five whorls remaining, with a well impressed suture; last whorl detached from the penult whorl near the aperture; aperture suborbicular, quite angular above; inner peritreme slightly produced; outer peritreme moderately expanding, shining, reflected exactly into the plane of the aperture, rather thick, nearly wanting opposite to the penultimate whorl, moderately produced above into a sharply angular concave wing; umbilicus very small."

Cyclostoma troscheli Pfeiffer, 1850 (translated from Latin): "Shell slightly perforate, oblong turret, thin, sculpture of elevated concentric lines and crossed over by crowded longitudinal plications, delicate, somewhat shiny, yellowish brown, spire elongate, barely truncate; suture denticulate; 5.5 slightly convex whorls, top smooth, forward narrowly solute, base with distinct spiral striations, crowded; aperture vertical, angulate-rounded; peristome thin, somewhat double, narrow and horizontally expanded, top somewhat tongue-shaped, angled. Operculum membranous, four-whorled, flat." 15 mm length.

Cyclostomus fallax Pfeiffer, 1851 (translated from Latin, from Pfeiffer, 1852a): "Shell umbilicate, oblong-turret, truncate, thin, with obtuse spiral lirae, with crowded decussate longitudinal lines (eight sometimes ten more or less well-developed), not scaly, barely shining, white, with wavy lines; marked with interrupted yellowish-brown; spire subconvex-turret; suture minutely fasciculated-crenulated; 4–4.5 remaining whorls slightly convex, last rounded, ornated below with medium yellowish-brown bands, front solute for a long way, around open umbilicus slightly spirally sulcate; aperture subvertical, oval; peristome white, double: inner a little expanded, appressed, outer short, more or less equally expanded in all directions, top angulated. Operculum?" 14 mm length.

Chondropoma tortolense Pfeiffer, 1857 (translated from Latin): "Shell narrowly perforate, ovate-turret, truncate, unequal spiral lirae, crowded ribs that cross, irregular varices simulating decussations, white-corneous, striped with red angular lines; spire rather regularly attenuated; suture with white bundles of crenulations; 4.5 remaining whorls moderately convex, front of last solute, carinate on back, marked between with medium red bands; aperture vertical, angulate-oval; peristome nearly double, outer top angulate, undulating." 15 mm length. (German translation): "Closely related with *Ch. Newcombianum* Ad., however by the notched peristome and the operculum, whose nucleus is more eccentric, it is distinguished."

Discussion: This species varies considerably in size, coloration, development of the outer lip, and prominence

of sutural tufts. This variability has led to several synonyms. Specimens vary not only by island but by populations within an island.

Cyclostoma lineolata Lamarck, 1822 was described from "les Antilles." A second label accompanying the syntypes reads "Portorico." Mermod (1952) never mentioned this second label but, somewhat incongruously, commented that van der Schalie (1948) had not found this species in Puerto Rico. Mermod also illustrated a specimen (his figs. 114a, b), which he stated was the largest of the lot. As pointed out by Dr. Peter Schuchert (in litt., Nov. 2013, MHNG) it is not. The type seems conspecific with specimens from St. John and the type locality is herein restricted to St. John, U.S. Virgin Islands.

Chondropoma tortolense variety "major" was listed from Puerto Rico by Martens (1882) but was not mentioned in the review of Puerto Rican annulariids by van der Schalie (1948). However, van der Schalie (1948) did suggest that *C. tortolense* might be only a form or subspecies of the Puerto Rican *Parachondria conseptus* (Martens, 1883), a conclusion with which I cannot concur. *Parachondria conseptus* (Martens, 1883) has much coarser sculpture and a more solute final whorl than does *P. lineolatus*.

Cyclostomus fallax was described from an unknown locality. It closely resembles specimens from Anegada.

Etymology: *Cyclostoma lineolata* Lamarck, 1822: L. *lineola*, small line; with small lines; *Cyclostoma newcombianum* Adams, 1849: Wesley Newcomb (1808–1892), American physician, conchologist, Hawaiian temperance leader; *Chondropoma swiftianum* Pfeiffer, 1851: Robert Swift (~1795–1872), collector in St. Thomas, Virgin Islands; *Cyclostoma troscheli* Pfeiffer, 1850: Franz Hermann Troschel (1810–1882), German conchologist, ichthyologist at Universität Bonn and Curator at Zoologisches Museum Berlin; *Cyclostomus fallax* Pfeiffer, 1851: L. *fallax* – deceptive; derivation unclear; *Chondropoma tortolense* Pfeiffer, 1857: Tortola + L. *-ensis*, from; from Tortola.

***Parachondria* (*Parachondria*) species**
(Figures 123–124)

A specimen from St. Croix (GTW 10099a) is closely related to *P. lineolatus*. It differs in the adnate final whorl, the attached outer lip to the previous whorl, the patterned outer lip, as well as having a broad, dark band within the umbilicus and a higher, narrower spire with one additional whorl. All of these characteristics are outside the range of variation seen in *P. lineolatus*. Annulariids are known for their highly endemic taxa and this specimen seems to represent an undescribed species. But because it is known from a single specimen lacking more precise locality data, it is not described here.

***Parachondria* (*Parachondria*) cf. *salleanus* (Pfeiffer, 1850b)**
(Figures 125, 138)

A single specimen from Sombrero Island (UF 119118) appears to belong to this Hispaniolan species. It seems unlikely that this species would naturally occur >525 km away from the Dominican Republic, bypassing Puerto Rico and the Virgin Islands. Sombrero Island was mined for guano and was visited on a regular basis by ships and workers; this record may be an anthropogenic introduction or a mislabeled specimen. I do not regard it as a natural part of the Lesser Antillean fauna.

***Parachondria* (*Parachondria*) *santacruzensis* (Pfeiffer, 1855)**
(Figures 82–93, 136–137)

Chresonymy

Cyclostoma santacruzense Pfeiffer, 1855: 101; Watters, 2006: 461.

Chondropoma santacruzensis (Pfeiffer, 1855). —Mörch, 1860: 12.

Chondropoma santacruzense (Pfeiffer, 1855). — Bland, 1861: 359, table 2; Reeve, 1863a: pl. 7, fig. 50; Pfeiffer, 1865: 154; Pfeiffer, 1876a: 196; Kobelt, 1880: 281; Weinland, 1880: 349; Jacobson, 1968: 20–21.

Chondropoma (*Chondropomorus*) *santacruzense* (Pfeiffer, 1855). —Henderson and Bartsch, 1921: 61.

Cyclostoma chordiferum Pfeiffer, 1855. —Jacobson, 1968: 20 [in synonymy of *Cyclostoma santacruzense* Pfeiffer, 1855].

Cyclostoma basicarinatum Pfeiffer, 1855. —Jacobson, 1968: 20 [in synonymy of *Cyclostoma santacruzense* Pfeiffer, 1855].

Cyclostoma kazika Weinland, 1876. —Jacobson, 1968: 20 [in synonymy of *Cyclostoma santacruzense* Pfeiffer, 1855]; Watters, 2006: 319 [as *nomen dubium*].

Parachondria (*Parachondria*) ? *santacruzensis* (Pfeiffer, 1855). —Watters, 2006: 44, 461.

Description: Shell medium-sized for genus (smallest= 10.7 mm, largest=14.5, average=12.2, decollated). Elongate conic, last whorl adnate or very narrowly solute for last ¼ turn. Umbilicus open, narrow. Protoconch of 1.5 rounded, smooth whorls. 3.5–5 decollated remaining whorls. Spiral sculpture of numerous rounded or flattened cords (ca. 12–15 on final whorl). Several cords on base are more prominent and widely spaced than elsewhere. Axial sculpture of numerous, coarse, closely spaced, erect lamellae, best developed over spiral sculpture where it has a scalloped appearance. Suture deeply indented, bounded by irregular, widely spaced, well-developed tufts. Tufts composed of 1–2 expanded but unfused lamellae with 2–5 much smaller, unexpanded lamellae between them. Aperture composed of an inner and an outer lip, teardrop-shaped, adnate or nearly so with previous whorl. Inner lip smooth, usually erect. Outer lip narrowly expanded, narrowest toward umbilicus, auriculate posteriorly, thickened, composed of numerous lamellae, anterior-medial edge scalloped in some specimens. Base color pale tan to reddish brown. Patterned with spiral rows of darker reddish or brown dots and dashes, neatly aligned vertically. Tufts and intersections of axial and spiral sculpture may be white. Lip white, often with color pattern continuing onto front of lips.

Outer color pattern may show through within aperture. Operculum paucispiral with a granulose deposit. Radula and anatomy unknown. Specimens often are covered in a very fine adherent sand or grit.

Type Material: ? Syntype: ZMB 65692, not located (Christine Zorn, in litt., Dec. 2013, ZMB). Additionally, Pfeiffer's material was not located by me at NHMUK in 2004.

Type Locality: "*Spring Gutt prope Christiansted insulae St. Croix.*"

Type Figure: Unfigured.

Other Material (Specimens Examined: 107): U.S. Virgin Islands, St. Croix, GTW 7303a (1), UF 27923 (8), UF 119184 (16), UF 158945 (5), UF 195541 (2); UF 27949 (55), Bellevue; UF 27956 (10), Davis Bay; UF 426186 (7), Estate Rattan, 166 m; UF 216876 (24), Teague Point; UF 216877 (2), "Santa Cruz Island, Solomons." British Virgin Islands, Tortola, UF 119182 (1).

Distribution: U.S. Virgin Islands, St. Croix; British Virgin Islands, Tortola, single record. One specimen, UF 216878, is labeled only "Puerto Rico." While it is not impossible that this species also occurs in Puerto Rico, van der Schalie (1948) did not include it in his revision of the annulariids of that island. It may be a mislabeled specimen.

Habitat: Under leaf litter, logs, stones. Known sites for this species in St. Croix are all in the northern hills of the island.

Variation among Specimens: Specimens vary primarily in the strength of the color pattern and the strength of the sutural tufts.

Comparison with Other Species: This species is obviously closely related to *P. basicarinatus*: both have a similar color pattern and enlarged basal cords. They differ primarily in size (*P. basicarinatus* averages 19.3 mm in length, *P. santacruzensis* averages 12.2 mm) and in the number of spiral threads on the final whorl (17–19 in *P. basicarinatus*, 12–15 in *P. santacruzensis*).

Original Description

(Translated from Latin): "Shell perforate, oblong-turret, narrow, longitudinal membranous ribs, undulating, sculpture dense, not shiny, reddish horn, colored with rows of reddish spots and one basal band; spire rather regularly attenuated, truncate; suture with unequally distant crenulated denticles; 4.5 remaining whorls moderately convex, front of last briefly solute; aperture vertical, oval, top subangulate; peristome double: inner slightly expanded, outer expanded, from penultimate whorl slightly detached, above and below narrowly perforated. Operculum flat, corneous." 11.5–12 mm length.

Discussion: Both *P. santacruzensis* and *P. basicarinatus* are similar to *P. conseptus* (Martens, 1882). That species is known only from the Aguas Buenas region in east-central Puerto Rico. *Parachondria conseptus* is a large species like *P. basicarinatus* and the two may have a common ancestor. *Parachondria santacruzensis* appears to be a miniature relative of the two.

Jacobson (1968) synonymized *Cyclostoma kazika* Weinland, 1876 with *P. santacruzensis*. *Cyclostoma kazika* was described with doubt from Haiti. The figures by Pfeiffer in 1876b are unrecognizable and the type is presumed lost. The specific name itself is enigmatic and gives no clue as to its provenance (*kazika* is Latin for goat). Watters (2006) regarded this taxon as a *nomen dubium*.

Etymology: L. *santacruzense*, Santa Cruz + L. *–ense*, from; from St. Croix.

Genus *Diplopoma* Pfeiffer, 1859

Subgenus *Diplopoma* Pfeiffer, 1859

Type Species: *Diplopoma architectonicum* Pfeiffer, 1859, by original designation.

Diplopoma (*Diplopoma*) *crenulatum* (Potiez and Michaud, 1838)

(Figures 94–122, 145–146)

Chresonymy

Cyclostoma crenulatum "Férussac *ex fide ipsa*" Potiez and Michaud, 1838: 235, Atlas [1844] pl. 24, figs. 3, 4; Watters, 2006: 220–221.

Chondropoma guadeloupense Pfeiffer, 1847b: 124; Reeve, 1863a: pl. 7, figs. 49a, b [in synonymy of *Cyclostoma crenulatum* Potiez and Michaud, 1838].

Cyclostoma guadeloupense (Pfeiffer, 1847). —Pfeiffer, 1849: 176, pl. 28, figs. 9–11 [pl. 1848?]; Petit de la Saussaye, 1850: 47; Pfeiffer, 1851: 173; Beau, 1852: 427; Pfeiffer, 1852a: 289–290; Pfeiffer, 1852b: 45; Reeve, 1863a: text to pl. 7; Watters, 2006: 283 [all, except for Pfeiffer, 1849, in synonymy of *Cyclostoma crenulatum* Potiez and Michaud, 1838].

Cyclostoma crenulatum "Michaud." —Petit de la Saussaye, 1850: 47; Beau, 1852: 427.

Chondropoma crenulatum ("Férussac" Potiez and Michaud, 1838). Pfeiffer, 1851: 173.

Chondropoma crenulatum ("Férussac") Pfeiffer, 1852a: 289–290; Pfeiffer, 1852b: 45; Adams and Adams, 1856: 295; Bland, 1861: 354; Reeve, 1863a: pl. 7, figs. 49a, b; Kobelt, 1880: 283; Vernhout, 1914: 183.

Cistula antiguensis "Shuttleworth" Pfeiffer, 1858: 131; Watters, 2006: 142–143.

Choanopoma occidentale Pfeiffer, 1861: 216, pl. 3, figs. 11–13; Bland, 1861: 358; Pfeiffer, 1865: 104–105; Pfeiffer, 1876a: 157; Kobelt, 1880: 282; Mazé, 1890: 32; Vernhout, 1914: 183; Watters, 2006: 384.

Cistula antiguensis "Shuttleworth." — Bland, 1861: 351; Pfeiffer, 1865: 142; Pfeiffer, 1876a: 187; Kobelt, 1880: 282.

Chondropoma antiguense (Pfeiffer, 1858). —Reeve, 1863b: pl. 10, fig. 72.

Chondroma [*sic*] *crenulatum* ("Férussac"). —Mazé, 1890: 32.
Chondropoma (*Chondropomorus*) *crenulata* ("Férussac"). — Henderson and Bartsch, 1921: 61.
Adamsiella (*Adamsiellops*) *antiguense* ("Shuttleworth"). — Henderson and Bartsch, 1921: 71.
Adamsiella (*Adamsiellops*) *occidentale* (Pfeiffer, 1861). — Henderson and Bartsch, 1921: 71.
Adamsiella antiguensis (Pfeiffer, 1858). Baker, 1928: 48.
Licina (*Choanopomops*) *antiguensis* ("Shuttleworth"). — Baker, 1928: 48.
Chondropoma (*Chondropomorus*) *antiguensis* ("Shuttleworth" Pfeiffer, 1858). —Bartsch, 1946: 199.
Adamsiella antiguensis ("Shuttleworth"). —Clench, 1956: 69.
Adamsiella (*Adamsiellops*) *crenulata* ("Férussac"). — Coomans, 1967: 126.
Adamsiella (*Adamsiellops*) *crenulata martinensis* "Bartsch MSS" Coomans, 1967: 126–128, figs. 39–41; Watters, 2006: 219—220.
Annularia (*Annularia*) *occidentale* (Pfeiffer, 1861). — Coomans, 1967: 128.
Diplopoma (*Diplopoma*) *crenulata martinense* (Coomans, 1967). —Watters, 2006: 35, 219–220.
Diplopoma (*Diplopoma*) *crenulatum crenulatum* (Potiez and Michaud, 1838). —Watters, 2006: 35, 220–221.
Diplopoma (*Diplopoma*) *sp.* Watters, 2006: 35.
Parachondria (*Parachondria*) *antiguensis* (Pfeiffer, 1858). —Watters, 2006: 44, 142–143.
Parachondria (*Parachondria*) *occidentalis* (Pfeiffer 1861). —Watters, 2006: 44, 384.
Diplopoma sp. Robinson et al., 2009: 625–625, figs. 8O, 9A,

Description: Shell small to medium-sized for genus (smallest=8.1 mm, largest=15.8, average=11.3, decollated). Elongate conic, last whorl barely adnate or more commonly very narrowly solute for last ¼ turn. Umbilicus open, narrow. Protoconch of 1.5 rounded, smooth, tan whorls. 3.5–5 decollated remaining whorls, most specimens are decollate. Spiral sculpture of numerous rounded threads, often weakly developed or indistinguishable, but more prominent in some populations (up to 19 on final whorl). Several cords on base are more prominent and widely spaced than elsewhere. Axial sculpture of numerous, fine, closely spaced, erect lamellae, best developed over spiral sculpture. Where spiral sculpture is better developed, surface has a scalloped appearance (Figure 114). In specimens where spiral sculpture is less developed or absent, surface has only sinuous, axial lamellae (Figure 112). Suture deeply indented to narrowly channeled, bounded by irregular groups of tufts. Tufts composed of 1–5 expanded and loosely fused lamellae with varying numbers of unexpanded lamellae between them. Tufts may be quite prominent (Figure 100) or nearly absent (Figure 115). Aperture composed of an inner and an outer lip, oval or teardrop-shaped, usually narrowly solute with previous whorl. Inner lip smooth, narrowly erect. Outer lip very narrowly expanded, narrowest toward umbilicus, narrowly auriculate posteriorly. Base color white to pale tan. Un-patterned or with vague pale tan spiral spots and bands; these are rarely prominent. Tufts and intersections of axial and spiral sculpture may be white. Lip white, rarely with color pattern continuing onto front of lips. Aperture white or tan; outer color pattern may show through within aperture. Operculum multispiral with an oblique, erect calcareous lamella. Radula and anatomy unknown.

Type Material: *Cyclostoma crenulatum* Potiez and Michaud, 1838: Douai Museum. According to the website of the Musée de la Chartreuse Douai, the "natural sciences collection [was] completely destroyed" during WW II; *Chondropoma guadeloupense* Pfeiffer, 1847: Not located and presumed lost; *Cistula antiguensis* Pfeiffer, 1858: Not located and presumed lost; *Choanopoma occidentale* Pfeiffer, 1861: ? Syntype: ZMB 65671, not located (Christine Zorn, in litt., Dec. 2013, ZMB). Additionally, Pfeiffer's material was not located by me at NHMUK in 2004.

Adamsiella (*Adamsiellops*) *crenulata martinensis* Coomans, 1967: Holotype: USNM 389964 (Figures 100–101); paratypes: USNM 389961 (26); USNM 652968 (23); USNM 636106 (31); "some paratypes have been donated to the Zoological Museum in Amsterdam."

Type Localities: *Cyclostoma crenulatum* Potiez and Michaud, 1838: "La Guadeloupe, sur la palmiste"; *Chondropoma guadeloupense* Pfeiffer, 1847: "Guadeloupe"; *Cistula antiguensis* Pfeiffer, 1858: "*in insula Antigua*"; *Choanopoma occidentale* Pfeiffer, 1861: "*in insulae Martinique*"; *Adamsiella* (*Adamsiellops*) *crenulata martinensis* Coomans, 1967: "Hill top east of Grande Case Bay, St. Martin."

Type Figures: *Cyclostoma crenulatum* Potiez and Michaud, 1838: pl. 24, figs. 3, 4 (Figure 94); *Chondropoma guadeloupense* Pfeiffer, 1847: Pfeiffer, 1849: pl. 28, figs. 9–11 [1848?] (Figure 97); *Cistula antiguensis* Pfeiffer, 1858: Unfigured; *Choanopoma occidentale* Pfeiffer, 1861: Pfeiffer, 1861: pl. 3, figs. 11–13 (Figure 99); *Adamsiella* (*Adamsiellops*) *crenulata martinensis* Coomans, 1967: Coomans, 1967, figs. 39–41.

Other Material (Specimens Examined: 967): Antigua, UF 212344 (6); OSUM 4155 (19), Saint Mary Parish; GTW 7064d (30), S of Veranda Resort, Saint Philip Parish; GTW 7064e (27), Half Moon Bay, Saint Philip Parish; UF 211008 (10), Willikies; Barbuda, UF 79058 (14), GTW 7064c (3); OSUM 36916 (22), GTW 7062a (2), Rubbish Bay; OSUM 36917 (66), GTW 7064a (3), Bull Hole; UF 258450 (35), 9.7 km NNE of St. Johns, between Codrington and The Caves; UF 211003 (21), UF 259949 (2), Codrington; Guadeloupe, UF 119152 (2), UF 216565 (2), UF 216566 (4); (Basse-Terre) UF 258460 (49), 2.5 km E of Trois-Rivières; (Grand-Terre) UF 258452 (53), 2 km SW of Château-Gaillard; UF 258455 (31), 6 km SE of Anse-Bertrand;

UF 258458 (19), 2 km E of Petit-Canal; UF 258459 (22), 2 km S of Le Moule; GTW 7064b (5), Le Moule; UF 258451 (58), 258461 (17), 1 km SE of Vieux Bourg; UF 258466 (8), 2 km SE of Vieux Bourg; UF 258463 (12), 0.8 km S of Sauvia; UF 258465 (6), 1 km N of Châteaubrun; UF 260040 (10), Plage de Babin, ca. 5 km W of Vieux Bourg, 200 m from sea; UF 258456 (49), 7 km NE of Les Abymes; UF 258469 (10), 8 km ENE of Les Abymes; UF 259784 (5), Grands Fonds; UF 260037 (26), near Bessons on SE outskirts of Pointe-à-Pitre; UF 260049 (6), Morne-à-l'Eau, 3 km S of Chasseau on rd. to Jabrun-St. Cyr, 500 m; UF 258457 (21), 2 km W of Morne-à-l'Eau; UF 258453 (28), 3 km NW of Gosier; UF 258464 (15), 6 km E of Gosier; UF 259942 (1), Gosier; UF 258462 (19), 5 km WSW of Sainte-Anne; UF 258468 (8), 4 km WSW of Sainte-Anne; UF 259941 (2), 1 km E of Sainte-Anne; GTW 7064 (2), GTW 11473a (3), Sainte-Anne; Marie-Galante, UF 259936 (7), Le Trou à Diable, 7 km NW of Capesterre-de-Marie-Galante; UF 259937 (2), 5 km SE of Grand-Bourg; UF 259938 (17), UF 259939 (7), 3 km NW of Grelin; GTW 7064g (2), 10 km N of St. Louis; Îles des Saintes, GTW 7064h (1), Terre-de-Bas; Martinique, UF 119137 (40), Sainte-Anne; UF 258446 (16), UF 259946 (2), 1 km SE of Sainte-Anne; UF 258448 (47), 1 km N of Sainte-Anne; UF 248447 (84), 7 km S of Le Vauclin; UF 258449 (15), Presqu'Île de la Caravelle, 3 km W of Tartane.

Distribution: Antigua: Widespread and often abundant; Barbuda: Widespread and often abundant; St. Martin/Sint Maartin: Recorded from St. Martin by Vernhout (1914) but this may apply to the Sint Maartin portion of the island as well. Coomans (1967) described *Adamsiella* (*Adamsiellops*) *crenulata martinensis* from Grande Case Bay, St. Martin; Guadeloupe: widely distributed on Grand-Terre, very rare on Basse-Terre; of the 43 lots from Guadeloupe, only one was from Basse-Terre: Marie-Galante: Apparently widely distributed; La Désirade, *fide* Robinson et al. (2009); Îles des Saintes; Terre-de-Bas; Dominica: reported from the battlements of Fort Shirley at Cabrit's Point by Robinson et al. (2009; see remarks below); Martinique: coastal localities along the eastern shore away from the mountains of the northwest.

Habitat: Potiez and Michaud (1838) mentioned that this species occurred on palm trees. The author has found it under coral debris, rocks, logs, and leaf litter in sandy soil under shrubs and trees in xeric conditions. In contrast to many other Lesser Antillean annulariids, this species prefers the lowlands, sometimes occurring within meters of the shore.

Variation among Specimens: Specimens vary not only among islands but among populations on a single, often small, island as well. Shells from Guadeloupe (Figures 107, 111, 120) tend to be wider and less attenuate than those from smaller islands (Figures 105, 115). The strength and numbers of spiral threads are often more developed on smaller islands. However, this is not always the case. On the small island of Barbuda, spiral sculpture may vary from coarse (Figure 113) to absent (Figure 112) between populations separated from each other by only a few kilometers.

Comparison with Other Species: This species superficially resembles *P. santacruzensis* in shell shape and sculpture. *Parachondria santacruzensis* is often much more colorful, with better defined sculpture. That species has a chondropomine operculum (paucispiral in a single plane) whereas *D. crenulatum* has an annularine operculum (multispiral with an erect lamella). There does not appear to be any overlap in the distributions of the two species as well.

Original Descriptions

Cyclostoma crenulatum Potiez and Michaud, 1838 (translated from French): "Shell subcylindrical, umbilicate, of the color of bright horn, transparent, and covered on the surface with longitudinal grooves joined in bundles of three and three, or of four and four, these which form the crenulations on the upper part of the spire; in some individuals the transverse grooves cut others, and render the shell latticed; spire composed of seven rather convex whorls; suture deep; opening nearly round and detached from the second whorl; summit nearly always truncate. Operculum forms a concentric spiral, and the detached part is an elevated, projecting lamella which produces a very attractive outward effect." 12–15 mm length.

Chondropoma guadeloupense Pfeiffer, 1847, was described in a footnote to an unrelated paper by Philippi in the *Zeitschrift für Malakozoologie* and not in 1849 in the *Systematisches Conchylien-Cabinet* as given by Watters (2006) (translated from Latin): "Shell narrowly perforate, oblong turret, decollate, solid, with transverse, acute, elevated longitudinal ribs, sculptured with transverse lirae above, cinnamon; suture with well-developed rather distant white denticles; four convex whorls; aperture vertical, oval; peristome red, continuous, double, inner a little expanded, appressed, outer narrowly expanded, slightly separated in proximity to penultimate whorl. Operculum thin, cartilaginous. Related to *C. xanthostomo* Sow., and certainly to *C. crenulato* M,. from both distinguished without trouble by sculpture." 11 mm length.

Cistula antiguensis Pfeiffer, 1858 (translated from Latin): "Shell somewhat perforate, turret-oblong, truncate, sculpture with obtuse spiral lirae, crossed over by crowded longitudinal plications, somewhat bundled, white, banded with interrupted obsolete red lines; suture irregularly nodulose-crenulated; five remaining whorls moderately convex, last not solute; aperture vertical, oval; peristome simple, hardly adnate, top angulate, narrowly expanded on all sides. Operculum typical." 12 mm length.

Choanopoma occidentale Pfeiffer, 1861 (translated from Latin): "Shell nearly perforated, oblong turret, solid, truncate, sculpture of obsolete bands of lirae and rope-like longitudinal ribs nearly bundled, not shining,

yellowish, sometimes with indistinct marks of interrupted red bands; spire regularly attenuated; suture irregular and strongly dentate; five remaining whorls convex, front of last solute; aperture subvertical, oval; peristome simple, narrowly expanded. Operculum with three whorls, elevated margins produced." 12.5–13 mm length.

Adamsiella (*Adamsiellops*) *crenulata martinensis* Coomans, 1967: "Shell like *crenulata*, but smaller, maximum size 13 mm. The adult has four to five whorls, the apical whorls being decollated. The color is pale light brown, the four spiral rows of reddish spots are hardly visible in the subspecies."

Discussion: This is by far the most widespread of the Lesser Antillean annulariids. The variation of this species among islands has resulted in the creation of several synonyms. Its abundance in Guadeloupe on Grand-Terre, in comparison to its great rarity on Basse-Terre, highlights this species' apparent habitat needs that are furnished only in the Limestone Caribees, but not in the Volcanic Caribees. Robinson et al. (2009) reported it (as *Diplopoma* sp.) from Cabrit's Point in Dominica and suggested it may have been introduced by anthopogenic means at the end of the 18th century. However, given this species' preference for the coastal plain on other islands, it is also possible that this species naturally occurs on Dominica and that Cabrit's Point represents one of the very few such habitats in mountainous Dominica; *D. crenulatum* may be naturally eking out its existence on an inhospitable island at this location.

Potiez and Michaud's (1844) figure of *Cyclostoma crenulatum* is a small and stylized rendition that does not match their description (Figure 94). It clearly does not have the seven whorls mentioned in the description or any indication of the sutural crenulations formed by three or four fused ribs. In the original description (1847b) Pfeiffer compared his *C. guadeloupense* to *C. crenulatum* but asserted that it was "distinguished without trouble by sculpture" [translated]; nevertheless, by 1851 he regarded the two species as synonymous. However, the description of *C. crenulatum* clearly describes a multispiral operculum with an elevated lamella, whereas Pfeiffer described the operculum of *C. guadeloupense* as thin and cartilaginous, a difference that cannot be reconciled at this time.

Adamsiella (*Adamsiellops*) *crenulata martinensis* Coomans, 1967, was distinguished primarily by its smaller size. However, the holotype is actually larger (12.0 mm) than the average size of the species across its range (11.3 mm). This subspecies falls within the range of variation in size and sculpture and is not here considered distinct.

Etymology: *Cyclostoma crenulatum* Potiez and Michaud, 1838: L. *crenulatus*, minutely crenulate.; *Chondropoma guadeloupense* Pfeiffer, 1847: L. Guadeloupe + L. *–ensis*, from; from Guadeloupe; *Cistula antiguensis* Pfeiffer, 1858: Antigua + L. *–ensis*, from; from Antigua; *Choanopoma occidentale* Pfeiffer, 1861: L. *occidentalis*, western; derivation unclear (this species is one of the eastern-most in the family); *Adamsiella* (*Adamsiellops*) *crenulata martinensis* Coomans, 1967: [St.] Martin + L. *–ensis*, from; from St. Martin.

***Diplopoma* (*Diplopoma*) *decussatum* (Lamarck, 1822)**
(Figures 126–130, 150)

Chresonymy

Cyclostoma decussata Lamarck, 1822: 147; Deshayes and Milne Edwards, 1838: 358; Delessert, 1841: pl. 29, figs. 6a,b,c; Pfeiffer, 1852a: 417; Baker, 1924: 91; Baker, 1928: 48; Mermod, 1952: 48–49, fig. 113.

Cyclostoma decussatum Lamarck, 1822. —Menke, 1830: 40; Sowerby, 1831: unpaginated; Reeve, 1862: pl. 22, fig. 148.

Cyclostoma decussatum "Pfeiffer." —Adams, 1847: 23; Pfeiffer, 1847a: 106; Pfeiffer, 1864: 159.

Cistula? *decussata* (Lamarck, 1822). Gray, 1850: 58.

Choanopoma decussatum (Lamarck, 1822). —Pfeiffer, 1851: 153; Pfeiffer, 1852a: 155; Pfeiffer, 1852b: 25; Adams and Adams, 1856: 296; Pfeiffer, 1858: 99; Bland, 1861: 358, 360; Pfeiffer, 1865: 100; Pfeiffer, 1876a: 156; Gundlach, 1878: 13; Kobelt, 1880: 279, 280; Fischer, 1885: 748; Aguayo, 1966: 14.

Choanopoma decussatum (Lamarck, 1822). —Pfeiffer, 1853: 109.

Cyclostoma (*Choanopoma*) *decussatum* Lamarck, 1822. — Shuttleworth, 1854b: 90.

Chondropoma decussatum (Lamarck, 1822). —Mörch, 1860: 12.

Choanopoma decussata (Lamarck, 1822). — Dall and Simpson, 1901: 435.

Annularia (*Annularia*) *decussatum* (Lamarck, 1822). — Henderson and Bartsch, 1921: 73.

Licina (*Choanopomops*) *decussata* (Lamarck, 1822). — Baker, 1924b: 2; Baker, 1962: 19.

Licina decussata (Lamarck, 1822). van der Schalie, 1948: 31, pl. 2, fig. 3, map 10.

Cyclostoma (*Choanopoma*) *senticosum* Shuttleworth, 1854. —van der Schalie, 1948: 31 [in possible synonymy].

non Cyclostoma decussatum "Lamarck" Sowerby, 1843: 165a, pl. 31A, figs. 300, 301 [= *Licina reeveana* Pfeiffer, 1852b, *fide* Bartsch, 1946: 175].

non Cyclostoma decussatum "Pfeiffer" Pfeiffer, 1849: 178–179, pl. 29, figs. 10–13 [pl. 1848?]; Pfeiffer, 1854c: pl. 38, figs. 38, 39 [=?; *fide* Mermod, 1852: 48].

non Licina decussata "Lamarck" Parkinson, 1987: 62, fig. 53, below middle [= *Parachondria lineolatus* (Lamarck, 1822)].

Description: Shell medium-sized for genus (smallest= 12.4 mm, largest=15.0, average=13.6, decollated). Elongate conic, last whorl narrowly solute for last ¼ turn. Umbilicus open, narrow. Protoconch of 1.5 rounded, smooth, tan whorls. 4–4.5 decollated remaining whorls, most specimens are decollate. Spiral sculpture of ca. 30 faint threads, widely spaced, particularly below

suture, slightly stronger in umbilicus. Axial sculpture of numerous, fine, closely spaced, erect lamellae. At intersections of spiral and axial sculpture, surface has a scalloped or finely beaded appearance. Suture shallow, not channeled, bounded by irregular groups of tufts. Tufts composed of one (rarely two fused) slightly expanded lamella. Aperture composed of an inner and an outer lip, oval, narrowly solute with previous whorl. Inner lip smooth, barely erect, inconspicuous. Outer lip narrowly expanded, much narrower toward umbilicus, scalloped on umbilical side in some specimens, with a small but prominent, concave auricle posteriorly. Base color tan to yellowish, with vague, brown spiral bands (most commonly at base), and axial, brown zig-zags. Tufts and intersections of axial and spiral sculpture white. Lip white, rarely with color pattern continuing onto front of lip. Aperture tan; outer color pattern prominent within aperture. Operculum multispiral with an oblique, erect calcareous lamella, often eroded off. Radula and anatomy unknown.

Type Material: Syntype MNHG., unnumbered.

Type Locality: "dans l'Île de Porto-Ricco. "

Type Figure: Mermod, 1952: fig. 113.

Other Material (Specimens Examined: 59): Spanish Virgin Islands, Isla de Vieques, UF 28647 (11), UF 28668 (10), Monte Pirata, near summit, 260 m; UF 28670 (9), Playa Caracas; Cayo Luis Peña, UF 23271 (29).

Distribution: Puerto Rico: Widely distributed, particularly in the northeastern part of the island (van der Schalie, 1948): Spanish Virgin Islands: Isla de Vieques, Cayo Luis Peña, and probably Isla de Culebra.

Habitat: In the Spanish Virgin Islands this species is widely distributed from sea level to the summit of Monte Pirata at 260 m, the highest point on Isla de Vieques. Its specific habitat is not recorded. Most of Isla de Vieques is a National Wildlife Refuge or a U.S. Naval restricted area; Cayo Luis Peña is a wildlife sanctuary.

Variation among Specimens: Specimens vary in the intensity of the color pattern and the strength of the suture sculpture but are otherwise quite uniform in the Lesser Antilles.

Comparison with Other Species: See under *Parachondria lineolatus*.

Original Description

(Translated from Latin) "Shell swollen-conic, barely perforate, decussate striations, yellowish-red; wavy longitudinal brown lines; six convex whorls; margin of lip white, reflected. 7 lignes" [ca. 15.8 mm].

Etymology: L. *decussatus*, with crossed-lines.

***Diplopoma (Diplopoma) sulculosum* (Pfeiffer, 1852)**
(Figures 131–134, 151)

Chresonymy

Cyclostomus sulculosus "Férussac" Pfeiffer, 1851: 166 [*nomen nudum*]; Pfeiffer, 1852a: 242; Pfeiffer, 1854b: 94; Watters, 2006: 497.

Cyclostomus suturale "Férussac" Pfeiffer, 1851: 166 [introduced in synonymy of *Cyclostomus sulculosus* Pfeiffer, 1851]; Pfeiffer, 1852b: 38 [in synonymy of *Cyclostomus sulculosus* Pfeiffer, 1851]; Reeve, 1861: pl. 16, fig. 105 [in synonymy of *Cyclostomus sulculosus* Pfeiffer, 1851]; Watters, 2006: 498 [in synonymy of *Cyclostomus sulculosus* Pfeiffer, 1851].

Cyclophorus sulculosus ("Férussac" Pfeiffer, 1852). —Pfeiffer, 1852b: 38.

Cyclostomus? sulculosus "Férussac" Pfeiffer, 1852. —Pfeiffer, 1853: 169.

Cistula sulculosa "Férussac." —Pfeiffer, 1854b: 95.

Cyclostoma sulculosum "Férussac" Pfeiffer, 1854d: pl. 41, figs. 15, 17, 22, 23; Pfeiffer, 1854e: 318.

Cyclostomus sulculosus "Férussac." Adams and Adams, 1856: 291.

Choanopoma sulculosum ("Férussac"). —Pfeiffer, 1858: 101; Bland, 1861: 358, 360, table 2; Pfeiffer, 1865: 103; Bland, 1866: 142; Pfeiffer, 1876a: 157; Kobelt, 1880: 280; Horst and Shepman, 1908: 356.

Cyclostoma sulculosum "Férussac." —Reeve, 1861: pl. 16, fig. 105.

Choanopoma sulculosum (Pfeiffer, 1852). —Kobelt, 1880: 282; Dall and Simpson, 1901: 435.

Annularia (Annularia) sulculosum ("Férussac"). —Henderson and Bartsch, 1921: 73.

Juannularia ? sulculosa (Pfeiffer, 1852). —Watters, 2006: 91, 497.

Description: Shell small for genus (smallest=9.6 mm, largest=15.0, average=11.8, decollated). Short conic, compact, solid, last whorl narrowly solute for last 1/8th turn. Umbilicus open, narrow, occluded by outer lip. Protoconch unknown. 3.75–4 decollate remaining whorls. Spiral sculpture of ca. 14 rounded, prominent chords, of equal strength. Axial sculpture of numerous, fine, closely spaced, erect lamellae. Suture deep, channeled, largely concealed by sutural tufts. Prominent tufts composed of irregular groups of erect, weakly fused lamellae, strongly concave adaperturally, often broken off. Aperture composed of an inner and an outer lip, oval, very narrowly solute with previous whorl. Inner lip smooth, barely erect, inconspicuous. Outer lip widely expanded, thickened, lamellate, much narrower toward umbilicus, scalloped on umbilical side in some specimens, with a prominent auricle posteriorly. Base color pinkish but overlain with white axial and spiral sculpture; bands absent. First remaining whorl dark reddish-brown. Lip white. Aperture tan to chestnut. Operculum, radula, and anatomy unknown.

Type Material: Six specimens at NHMUK, unnumbered, labeled with Pfeiffer's handwriting, from the Cuming collection, are probably syntypes (Figure 131).

Type Locality: "*in insula Guadeloupe*."

Type Figure: Pfeiffer, 1854c: pl. 41, figs. 15, 17, 22, 23.

Other Material (Specimens Examined: 3): Anguilla, GTW 11473b (1); UF 48708 (1), Isaac's Cliff, Blackgarden's Bay; UF 48713 (1), E edge of Katouche Bay Valley.

Distribution: Anguilla: Eastern Katouche Bay Valley and Blackgarden's Bay. Isla de Vieques, Guadeloupe, Saint Bartélemy, *fide* Bland (1861, 1866); however, I have not seen specimens from these islands. It is unlikely that it occurs at Isla de Vieques. This appears to be a rare species.

Habitat: Not recorded.

Variation among Specimens: The few specimens seen vary in the degree to which the sutural tufts are developed or worn away.

Comparison with Other Species: The heavy spiral cords and unusual scalloped sutural tufts are unique.

Original Description

(Translated from Latin) "Shell barely umbilicate, oblong, solid, with elevated lirae, sculpture with crowded longitudinal lines, with crossed lirae (four to five may be strong), not shining, yellowish-red; spire gradually attenuated, truncate; suture somewhat channeled, with irregular and distant thickened crenulations; 4 remaining whorls slightly convex, front of last slightly solute; aperture vertical, oval, brown inside; peristome white, double: inner a little expanded, appressed, outer narrowly expanded, top of lip a triangular elevation, to penultimate whorl very narrow, left margin narrow. Operculum ?" 14 mm length.

Discussion: This peculiar species is placed in *Diplopoma* with reservations. I have not seen the operculum but Henderson and Bartsch (1921) placed it in *Annularia* suggesting a multispiral, lamellate operculum. It strongly resembles the Cuban *Juannularia* but no intervening forms occur between Cuba and the Lesser Antilles. It does not seem closely related to any other Lesser Antillean form and may deserve its own genus.

Etymology: L. *sulcus*, wrinkled or furrowed.

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Bartschia (Agassitula) peartae, a new species of colubrariid (Gastropoda: Colubrariidae) from the tropical western Atlantic

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ABSTRACT

A new western Atlantic species belonging to the "*Metula*" group is described and assigned to the subgenus *Agassitula*, which is provisionally included in the genus *Bartschia*. This new species, *Bartschia (Agassitula) peartae*, is larger, thinner, more fusiform, and more densely pigmented than other western Atlantic members of the "*Metula*" group.

Additional Keywords: "*Metula*" group, protoconch, larval development

INTRODUCTION

The genus *Metula* (H. and A. Adams, 1853:84) was first proposed to include four deep-water buccinoidean species with fusiform, finely cancellated shells. Kobelt (1876: 38–39) subsequently designated *Buccinum clathratum* A. Adams and Reeve, 1850, as the type species. As detailed in a review by Emerson (1986), the type locality originally reported as off South Africa was erroneous and had been corrected by Tomlin (1927: 160), who concluded that the type material came from the Pacific coast of Colombia. Emerson (1986: 27) also noted that that the binomen *Buccinum clathratum* had previously been used by both Kiener (1834: 101) and Anton (1839: 91), and that *Metula amosi* Vanatta, 1913 is the oldest available name for the type species of *Metula*.

As the number of species described as *Metula* has increased (> 40 Recent and fossil species), they have been variously apportioned among several supraspecific taxa (Table 1) that have been proposed, synonymized, or transferred between the families Buccinidae and Colubrariidae largely based on interpretations of shell morphology.

Several of these supraspecific taxa have been referred to the family Colubrariidae on the basis of anatomical studies (e.g., Ponder, 1974: 328; Vermeij, 2001: 297), but most subsequent authors (e.g., Olsson and Bayer, 1972; Kilburn, 1975; Houbrick, 1984; Emerson, 1986; Beu and Maxwell, 1987) concurred with Cernohorsky (1971), placing *Metula* and related genera in the subfamily Pisaniinae of the Buccinidae. A recent molecular study (Oliverio and Modica, 2009: 794, figs. 5, 6) included *Metula amosi*, the type species of *Metula*, within a strongly supported clade as the sister taxon to four species of *Colubraria*, confirming its placement within Colubrariidae.

Among the specimens collected in the Bahamas using the DSV Johnson-Sea-Link research submersibles over the past several decades were three crabbed individuals of a distinctive new species most similar to *Metula agassizi* Clench and Aguayo, 1941, the type species of *Agassitula* Olson and Bayer, 1972. More recently, an additional crabbed specimen was collected in traps off the southwestern coast of the Dominican Republic. This new species is described herein, and provisionally assigned to *Agassitula*, which had been proposed as a subgenus of *Metula*, and subsequently synonymized with both *Metula* (Bouchet, 2014) and *Bartschia* Rehder, 1943 (Beu and Maxwell, 1987: 62). *Bartschia* has been recognized as a genus by some authors (Bayer and Olsson, 1972: 924; Beu and Maxwell, 1987: 62; Garcia, 2008:144), but considered to be a subgenus of *Metula* by others (Bouchet, 1988; Bozzetti, 1993).

A revision of the systematics of this large and complex lineage within Colubrariidae is clearly needed. In the interim, data are provided that serve to distinguish *Bartschia* from *Metula*, and to differentiate *Bartschia* from *Agassitula*.

SYSTEMATICS

Family Colubrariidae Dall, 1904

Genus *Bartschia* Rehder, 1943

Type species, by original designation, *Bartschia significans* Rehder, 1943.

Diagnosis: Shell (Figures 17–19) large for the family (to 55 mm), solid, with elevated conical spire, evenly rounded whorls lacking a shoulder, and a short, broad,

Table 1. Supraspecific taxa related to *Metula* in the chronological order.

Metula H. and A. Adams, 1853. Type species, by subsequent designation of Kobelt (1976), *Buccinum clathratum* A. Adams and Reeve, 1850 [not *Buccinum clathratum* Kiener (1934:101) or Anton (1839:91)] = *Metula amosi* Vanatta, 1913. Recent, eastern Pacific.

Acamptochetus Cossmann, 1901. Type species, by original designation, *Murex mitraeformis*, Brocchi, 1814. Mio-Pliocene Italy. = *Metula* (Emerson, 1986:27; Beu and Maxwell, 1987:62).

Antimitra Iredale, 1917. Type species, by original designation, *Pleurotoma aegrota* Reeve, 1845. Recent, Singapore. = *Metula* (Kilburn, 2004: 269).

Antemetula Rehder, 1943. Type species, by original designation, *Buccinum metula* Hinds, 1944. = *Acamptochetus* (Cernohorsky, 1971:151), = *Metula* (Emerson, 1986:27; Beu and Maxwell, 1987:62).

Bartschia Rehder, 1943. Type species, by original designation, *Bartschia significans* Rehder, 1943. Recent, Florida Keys. = *Metula* (*Bartschia*) (Bouchet, 1988:150; Bozzetti, 1993:111); = *Bartschia* (Beu and Maxwell, 1987: 62; García, 2008:144).

Kanamaria Kuroda, 1951: 59–70. Type species, by original designation, *Colus (Aulacofusus) adonis* Dall, 1919. Recent, Japan. [Originally described as a subgenus of *Metula*, transferred to Colubrariidae by Fraussen and Lamy (2008).]

Colubrarina Kuroda and Habe *in* Kuroda, Habe and Oyama, 1971. Type species by original designation, *Antemetula* (*Colubrarina*) *metulina* Kuroda and Habe *in* Kuroda, Habe and Oyama, 1971. Recent, NW Pacific. = *Metula* (Emerson, 1986:27; Beu and Maxwell, 1987:62).

Minitula Olsson and Bayer, 1972. Type species, by original designation, *Metula (Minitula) minor* Olsson and Bayer, 1972. Pliocene, Florida. ? = Columbellidae (Beu and Maxwell, 1987:62).

Agassitula Olsson and Bayer, 1972. Type species, by original designation, *Metula agassizi* Clench and Aguayo, 1941. = *Acamptochetus* (*Agassitula*) (Houbrick, 1984: 423); = *Metula* (Bouchet, 2014); = *Bartschia* (Beu and Maxwell, 1987:62).

Floritula Olsson and Bayer, 1972. Type species, by original designation, *Metula robertsi* Olsson, 1967. Pliocene, Florida. = *Metula* (Beu and Maxwell, 1987:62).

Caseyella MacNeil *in* MacNeil and Dockery, 1984. Type species, by original designation, *Metula (Caseyella) neptuneiformis* MacNeil *in* MacNeil and Dockery, 1984. Oligocene, SE United States. = *Bartschia* (Beu and Maxwell, 1987:62).

dorsally deflected siphonal canal that crosses the coiling axis of shell. Protoconch (Figures 26, 27) large, dome-shaped, increases in diameter from 223 µm to 2.4 mm in 3¼ smooth, evenly rounded whorls. Transition to teleoconch distinct, marked by onset of 8 spiral cords, followed after ¼ whorl by appearance of axial riblets (~30 per whorl). Suture adpressed. Spiral sculpture of rounded cords that intersect with opisthocline axial riblets of similar prominence on early whorls, producing a cancellated pattern. Spiral cords become stronger than axial riblets after 4th teleoconch whorl. Aperture oval, broad, about ½ shell length; anal canal accentuated by thickening along posterior region of outer lip. Outer lip with thickened varix with short denticles, most pronounced along central portion. Parietal region and columella with thick callus. Shell base color whitish yellow, with 4 bands of chestnut brown maculations at the suture, shell periphery, anterior to shell periphery, and along tip of siphonal canal. Aperture white.

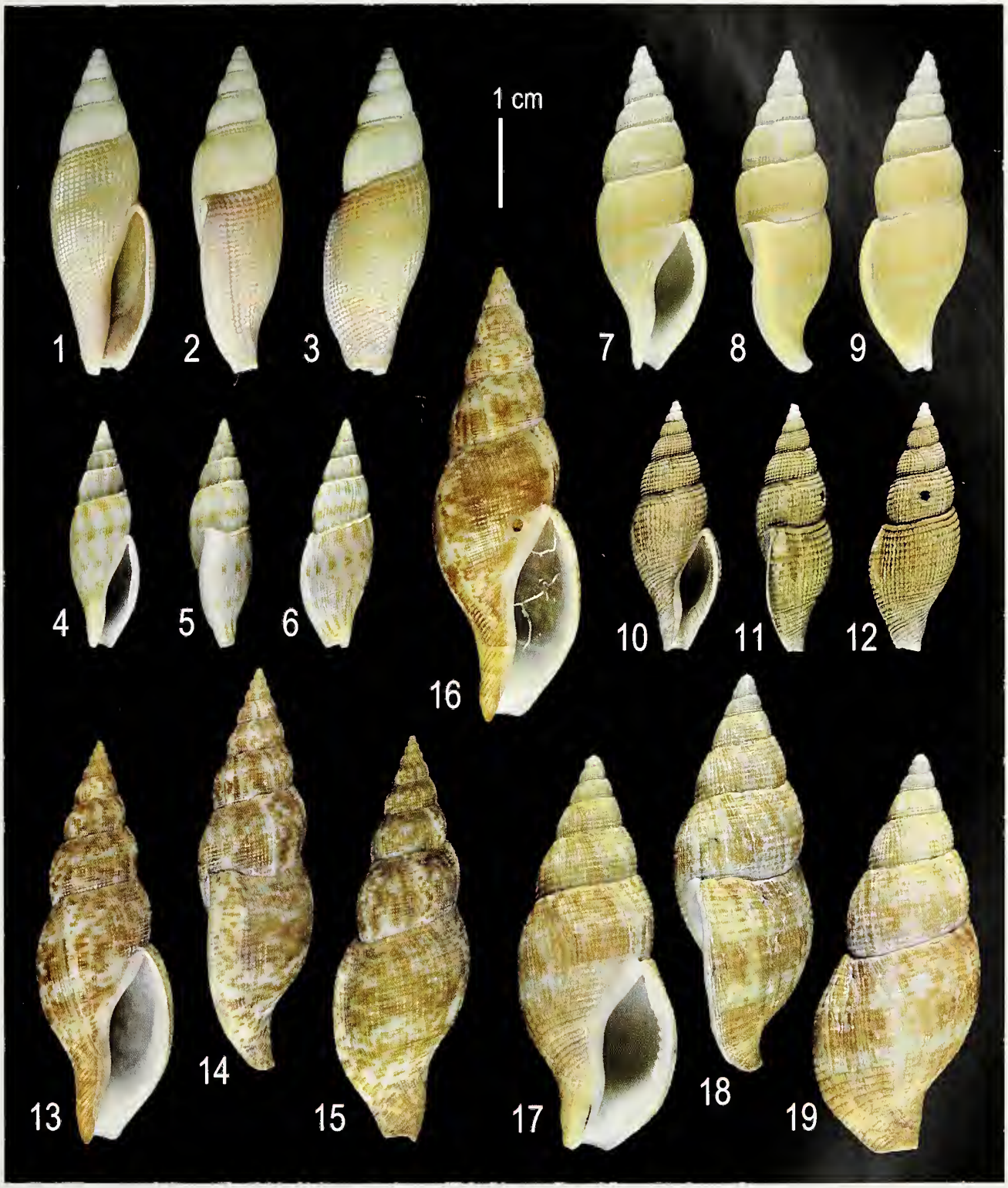
Remarks: *Bartschia* may be readily distinguished from *Metula* (Figures 1–3), as exemplified by their respective type species, in having a proportionally broader shell with more evenly rounded whorls, a shorter, wider aperture with more pronounced denticles along the outer lip, slightly coarser sculpture with spiral cords dominant, and a color pattern consisting of four spiral brown bands. The spiral cord bordering the suture is not enlarged. The protoconch of *Bartschia* is diagnostic in being dome-shaped and consisting of 3¼ smooth, rounded whorls that increase in diameter tenfold from first to last whorl (Table 2).

Subgenus *Agassitula* Olsson and Bayer, 1972

Agassitula Olsson and Bayer, 1972. Type species, by original designation, *Metula agassizi* Clench and Aguayo, 1941.

Diagnosis: Shell (Figures 7–9) of moderate size for the family (to 39 mm), solid, with tall, elongated, conical spire (about ½ shell length), evenly rounded whorls, narrow aperture, and a long, slender, attenuated, dorsally reflected siphonal canal that crosses the coiling axis of shell. Protoconch (Figures 22, 23) increases in diameter from 350 µm to 1.5 mm in about 2 smooth, glassy whorls. Transition to teleoconch distinct, marked by onset of 4–5 spiral cords, followed within ⅛ whorl by axial riblets. Suture adpressed. Sculpture of weaker rounded spiral cords and stronger opisthocline axial riblets intersecting to produce a cancellated pattern. Ribs and cords of equal strength by 5th teleoconch whorl. Aperture oval, generally broadest posterior to midpoint. Outer lip thickened to produce sinuate varix, lined with short denticles. Shell color ivory, with traces of 4 brownish spiral bands in some specimens.

Remarks: *Agassitula* (Figs. 7–16) may be distinguished from *Bartschia* (Figs. 17–19) and *Metula* (Figs. 1–6) in having a more elongated shell with a spire that is generally equal to or greater than half the shell length, an ovate aperture, and a more elongated siphonal canal that is distally attenuated and recurved. Pigmentation is variable. The four bands may be barely discernible, or pronounced to the point of overlapping. The



Figures 1–19. Shells of *Metula* and *Bartschia* species. **1–3.** *Metula amosi* Vanatta, 1913, USNM 518256, dredged in Panama Bay, Panama. **4–6.** *Metula metula* (Hinds, 1844), USNM 824614, Tayabas Bay, Marinduque, Philippine Islands, trawled in deep water. **7–9.** *Bartschia (Agassitula) agassizi* (Clench and Aguayo, 1941), USNM 810504, 5 miles NE of Alicetown, North Bimini, Bahamas, in 45–115 fms, R/V Silver Bay sta. 2488. **10–12.** *Bartschia (Agassitula) guppyi* Olsson and Bayer, 1972, holotype, USNM 706729, off Bocas de Drago, NW of Trinidad, in 137–143 m, R/V Pillsbury Sta. P-849. **13–16.** *Bartschia (Agassitula) peartae* new species. **13–15.** Holotype, USNM 1004131. **16.** Paratype 1, both off Fernandez Bay, San Salvador, Bahamas, in 271 m, DSV Johnson-Sea-Link 1 sta. JSL-1-2328. **17–19.** *Bartschia significans* Rehder, 1943, holotype, USNM 516493, dredged off the Dry Tortugas, Florida Keys. 1 cm scale bar applies to all images.

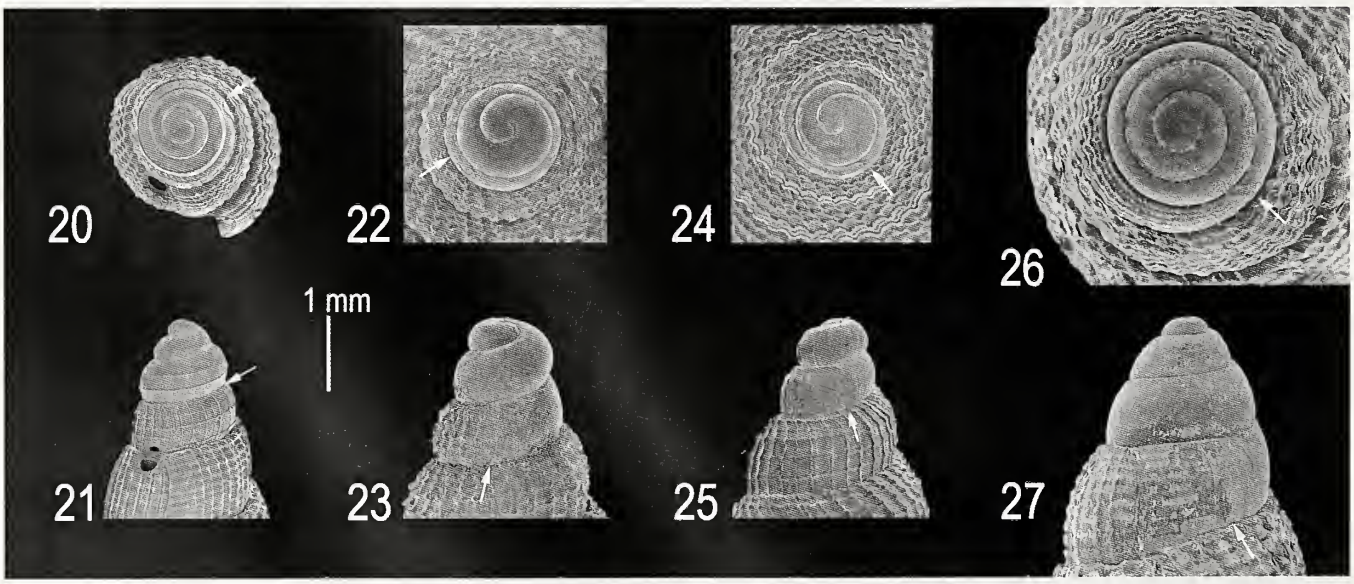
Table 2. Measurements of illustrated specimens. AL = Aperture length; AW = aperture width; SL = shell length; SW = Shell width. D initial = initial diameter of the protoconch; D final = final diameter of the protoconch.

	Metula amosi	*Metula metula*	*Agassitula agassizi*	*Agassitula peartae* n. sp.	*Bartschia significans*
AL/SL	0.503	0.521	0.492	0.517	0.519
SW/SL	0.314	0.312	0.342	0.334	0.401
AW/AL	0.279	0.277	0.351	0.494	0.380
Protoconch D initial	?	361 µm	350 µm	286 µm	223 µm
Protoconch D final	?	1.3 mm	1.5 mm	1.3 mm	2.4 mm
Protoconch # whorls	?	2½	2	1¾	3¼

protoconch of *Agassitula* most closely resembles that of *Metula amosi* (as extrapolated from incompletely preserved examples) in size, shape and number of whorls, but these both differ from Indo-Pacific species attributed to *Metula* (Figs. 4–6, 20–21).

Bartschia (Agassitula) peartae new species
(Figures 13–16, 26–27)

Description: Shell (Figures 13–16) large for genus (to 71 mm), thin, biconical, fusiform, with tall, narrow spire (spire angle 28–34°) comprising more than ½ total shell length. Protoconch (Figures 24–25) increasing in diameter from 268 µm to 1.3 mm in 1¾ glassy, rounded whorls, with fine axial growth striae near teleoconch. Transition to teleoconch (Figures 24–25, arrows) marked by formation of incised suture and 3 broad spiral cords (apical most prominent and first to be formed) followed by axial ribs that become stronger and more regularly spaced within ¼ whorl. Teleoconch with up to 8 evenly rounded, convex whorls without distinct shoulder, with periodic thickened varices beginning on third teleoconch whorl, occurring every ¾–1 whorl thereafter. Suture adpressed by third teleoconch whorl. Spiral sculpture of 35–37 rounded cords on last whorl; 13–15 cords on siphonal canal, and 21–23 on penultimate whorl, intersecting with similarly spaced, slightly curved, opisthocline axial ribs (67–70 on final whorl) to produce a finely reticulated pattern of squarish nodes over the surface of the shell. Spiral sculpture more prominent on early whorls; axial sculpture slightly dominant on later whorls. Aperture large, narrow, deflected from coiling axis by 9–11°, with a weakly delimited anal canal. Outer lip with narrow, thickened, rounded varix with 23–26 short denticles, sharpest posteriorly, becoming broader, more rounded and less distinct anteriorly, absent along siphonal canal. Parietal callus thin along inductura, slightly thicker along smooth, axial columella. Siphonal canal long, broad, open, deflected dorsally and adaxially, without forming fasciole or pseudoumbilicus. Shell base color white to light tan, with numerous small, elongated golden brown spots coalescing to form irregular, mottled patterns that



Figures 20–27. Scanning electron micrographs (apical and lateral views) of the protoconchs of: **20–21.** *Metula metula* (Hinds, 1844), USNM 279906, Butung Strait, 6.5 miles SE of Tikola Peninsula, Sulawesi, Indonesia, trawled in 68 m. **22–23.** *Bartschia (Agassitula) agassizi* (Clench and Aguayo, 1941) (Specimen in figures 7–9). **24–25.** *Bartschia (Agassitula) pertae* new species, holotype, USNM 1004131. **26–27.** *Bartschia significans* Rehder, 1943, USNM 450812, RV Eolis sta. 323, 110 fms, off Sand Key, Florida, 1916. 1 mm scale bar applies to all images. Arrows indicate transition from protoconch to teleoconch.

are darkest and densest in four spiral bands, the widest along the shell periphery. Aperture white along periphery, brownish interiorly (as a result of its being translucent.)

Type Locality: Off Fernandez Bay, San Salvador, Bahamas (24° 1.7′ N, 74° 32.65′ W), in 271 m, DSV Johnson-Sea-Link I, sta. JSL-I-2328.

Type Material: Holotype, USNM 1004131, Paratypes 1–2, USNM 1250297, from the type locality; Paratype 3, G. Everson collection, off Isla Beata, southwestern coast of the Dominican Republic, in trap in 61–122 m.

Distribution: This species is presently known from the central Bahamas and the SW coast of the Dominican Republic, at depths from 61–271 m.

Etymology: This species is named in honor of Ms. Marie Peart, in recognition of her contributions and service to The Bailey-Matthews National Shell Museum.

Comparative Remarks: Although much larger in size, the shape of this species most closely resembles *Metula miocenica* Schmeltz and Portell, 2003, from the Miocene Chipola Formation of Northern Florida, and the Recent *Bartschia* (*Agassitula*) *agassizi*, from comparable depths off Florida and Cuba. It differs from both in having a thinner shell, with much finer surface sculpture and weaker dentition along the outer lip. The coloration of this new species approximates that of *Bartschia significans* and to a lesser degree *Metula metula* (Hinds, 1844) (Figures 4–6). From the former, it differs in having a more fusiform shell with a proportionally taller spire, and finer, more evenly cancellated sculpture. From the latter, it differs in its larger size, more diffuse coloration, and the lack of an enlarged spiral cord along the suture. It may easily be distinguished from both on the basis of significant differences in protoconch morphology. The protoconch of *Bartschia (Agassitula) peartae* (Figures 24–25) is far smaller and has fewer whorls than that of *Bartschia* (*Bartschia*) *significans* (Figures 26–27). Although more similar in size to the protoconch of *Metula metula* (Figures 20–21), it lacks the pustules on the first half whorl and subsequent spiral threads present on the protoconch of that species.

DISCUSSION

Members of the "*Metula*" group (loosely defined as species described in or subsequently referred to one of the supraspecific taxa listed in Table 1) inhabit subtidal to bathyal soft bottom substrates in tropical and temperate oceans. Most are relatively rare in collections and known only from their shells. Radulae have been described for few species (Bouchet, 1988; Ponder, 1974). In addition to the molecular studies of Oliverio and Modica (2009, see above), Kantor et al. (2013: 2) included sequences of *Metula* sp., which served as an outgroup in their studies of deep-sea wood-dwelling buccinids.

Much work remains to be done to unravel the relationships among these many taxa, a task made more difficult by the paucity of anatomical and molecular material. Although the majority of examined specimens had protoconchs that were either worn or broken, there is nevertheless considerable variation in protoconch morphology among the many species included in this group. Altena (1949: figs. 1–7) made use of distinctive protoconch morphologies to distinguish species and lineages of Indo-Pacific taxa and speculated that they differed considerably in their larval ecology.

The protoconch of *B. significans* differs from those of other members of the *Metula* group in having a smaller initial diameter (indicating a smaller egg size) that increases tenfold prior to metamorphosis (suggesting the presence of nurse eggs in the egg capsule). This species appears to have a limited geographical range compared to species of *Agassitula*, which have a protoconch typical of species with direct development. Protoconch morphology of *Metula metula* and some of the species treated by Altena as *Antemetula* indicates a planktonic larval stage for some Indo-Pacific taxa.

ACKNOWLEDGMENTS

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Two new giant carnivorous land snails of the genus *Euglandina* (Gastropoda: Pulmonata: Spiraxidae) from Honduras

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ABSTRACT

Two giant species of the genus *Euglandina* are described from Honduras. Both have very restricted distributions at intermediate elevations on Cerro Santa Barbara. They belong to a species group that includes five other remarkably large species from Mexico and Central America.

Additional Keywords: New species, pulmonate, Central America, Cerro Santa Barbara

INTRODUCTION

The Spiraxidae is a large family of carnivorous land snails found in tropical America and Mediterranean Europe. *Euglandina* is a diverse genus. It is distributed from the southern United Sates to Bolivia. Forty-four species are recognized in Mexico and Central America, but this is undoubtedly an under-measure of the taxonomic diversity of the genus, because most of the region remains poorly explored for its molluscan fauna. Species vary in size from the minute—*Euglandina* (*Guillarmodia*) *brachystyla* Thompson, 1995, which reaches a length of 6.4 mm, to the gigantic and ponderous *Euglandina* (*Euglandina*) *titan* Thompson, 1987, which attains a length of 112 mm. Giant species of *Euglandina* comprise a group of extraordinary large species within the subgenus *Euglandina* from Mexico and Central America (Thompson, 1987). These include *E. sowerbyana sowerbyana* (Pfeiffer, 1846), *E. sowerbyana estephanae* (Strebel, 1875), *E. gigantea* Pilsbry 1926, *E. aurata* (Morelet, 1849), *E. titan* Thompson, 1987, *E. pan* Thompson, 1987, and *E. vanuxemensis* (Lea, 1834). On the basis of color patterns, which consist of incremental, rust-colored flames and granular sculpture, it appears that the first five species comprise a natural group. The last species is more distantly related.

Giant *Euglandina* species are seldom found, judging by the few specimens that have made their way into malacological collections and on the basis of my field experiences. Relatively few specimens are available for taxonomic analysis, and seldom are more than one or two specimens available from any single locality. The discovery of two new giant species from Honduras is worthy of notice. Molluscan surveys of selected regions of Honduras were made by the author during 1993–1995. The two new species were found on only a few occasions, and these were from very restricted localities on Cerro Santa Barbara, a mountain massif reaching 2700 m in altitude and consisting mostly of karst limestone. The mountain has steep slopes on all sides making access to higher elevations very difficult. Much has yet to be learned about the molluscan fauna of there, as well as of higher elevations elsewhere in Honduras.

No Central American country can be described as well-known malacologically. Certainly Costa Rica has the best documented fauna, and Honduras has the least. Most areas in Honduras remain poorly explored for mollusks. Only two other species of *Euglandina* are known from there, *E.* (*Singleya*) *carminensis* (Morelet, 1849) and *E.* (*Cosmonemus*) *cumingi* (Beck, 1837) (Thompson, 2011).

This study is prompted by the necessity to make known two extraordinary species of land snails, and add to our knowledge of the Honduran fauna.

MATERIALS AND METHODS

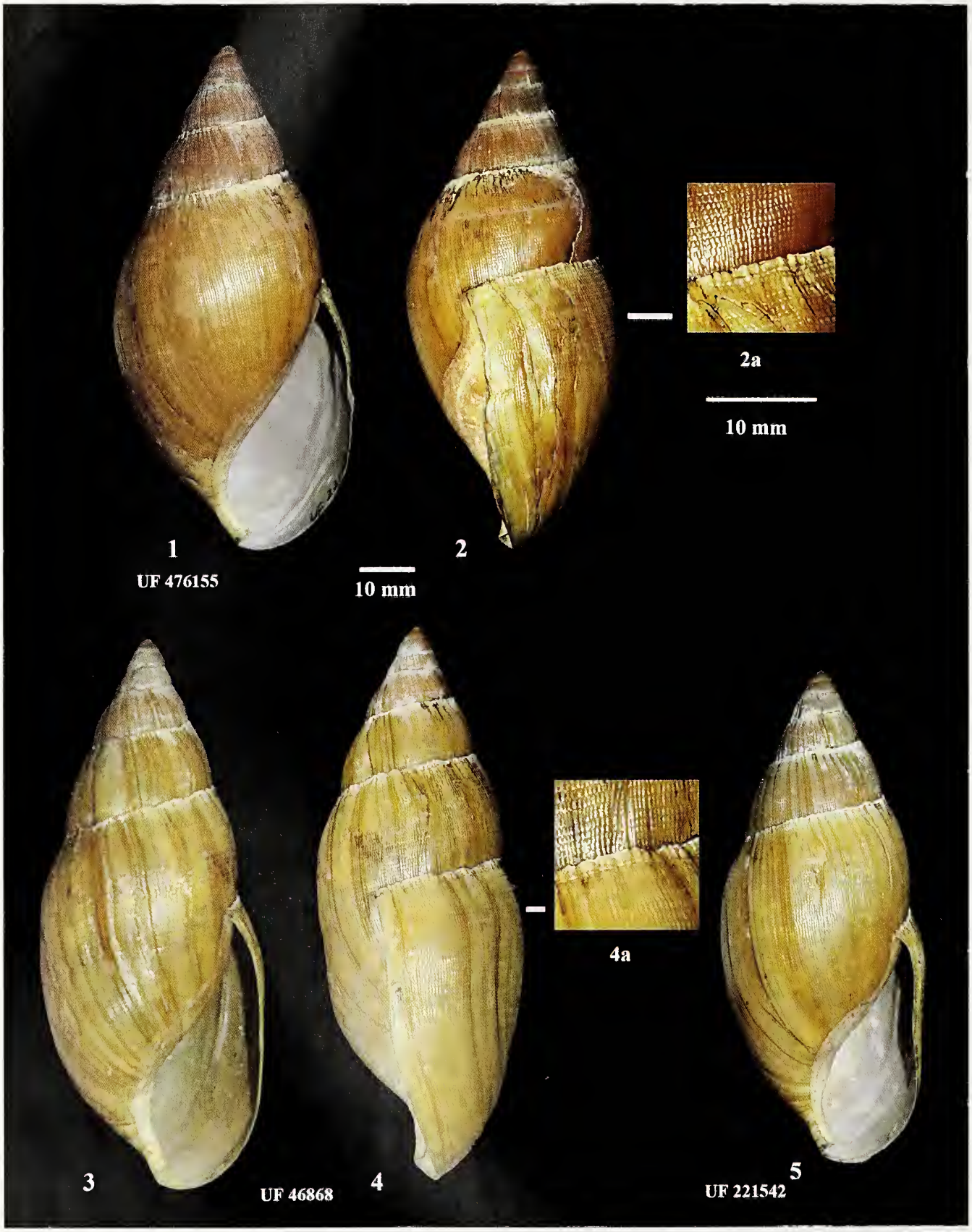
Specimens are deposited in the Malacology Collection at the Florida Museum of Natural History (UF). Measurements are standard. The shell length (SL) is from the apex to the base of the peristome parallel to the shell axis. The shell width (SW) is the widest part of the shell perpendicular to the shell axis. The aperture height (ApH) is the length of the aperture in a plane parallel to the shell axis. The number of whorls (Wh) is counted from the initial suture of the first whorl of the protoconch to the outer peristome.

SYSTEMATICS

Euglandina (*Euglandina*) *hyperion* new species

(Figures 1–2, Table 1)

Diagnosis: Giant species of the subgenus *Euglandina* with elongate-ovate shell up to 92 mm long and up to



Figures 1–5. New species of *Euglandina*. **1, 2.** *Euglandina hyperion* new species. Holotype, UF 476155. **3–5.** *Euglandina encladus* new species. **3–4.** Holotype, UF 488668. **5.** Paratype, UF 221542. Shell measurements in Tables 1, 2.

Table 1. *Euglandina hyperion* new species. Shell measurements of holotype (UF 476155) and three paratypes, all from type locality (San Luís de Planes); m alt = altitude in meters, other abbreviations explained in Materials and Methods.

Specimen	m alt	SL	SW	ApH	Wh	SW/SL	ApH/SL
Holotype	1300	92	45	47	7+	0.49	0.51
UF 221084	1300	82	38	44	8.0	0.46	0.54
UF 221056a	1400	82	38	46	7.9	0.46	0.55
UF 221056b	1400	79	38	45	7.8	0.48	0.57

Table 2. *Euglandina encladus* new species. Shell measurements of holotype (UF 468668), two paratypes (UF 221542), and a specimen from 3 km west of Nueva Esperanza (UF 194565). Abbreviations explained in Materials and Methods.

Specimen	SL	SW	ApH	Wh	SW/SL	ApH/SL
Holotype	93	38	48	7.3	0.41	0.52
Paratype	86	39	47	7.2	0.46	0.55
Paratype	84	35	42	7.2	0.42	0.50
UF 194565	84	36	44	7.3	0.43	0.52

8.0 whorls separated by moderately impressed suture. Shell light golden-brown with slightly darker spire and narrow white sub-suturale zone demarcating crenulate sculpture bordering suture. Suture crenulated with enlarged white denticles. Shell surface sculptured with fine incremental growth threads crossed by spiral striations, producing vertically elongate granular tubercles about as high as wide. Aperture about half shell length, with short, strongly flexed columella.

Description: Shell moderately thick-walled and opaque, large, up to 92 mm long and 0.46–0.49 times as wide as long. Shell longate-ovate with straight-sided spire and tumid body whorl. Shell color light-brown, with occasional darker streaks along fracture zones and irregular, narrow white sub-sutural zone. Upper whorls darker. Aperture interior livid-white. Whorls 7.8–8.0. Protoconch smooth, slightly raised, consisting of 2.2 whorls only weakly differentiated from teleoconch. First protoconch whorl raised. Whorls separated by strongly impressed suture, distinctly arched. Protoconch smooth. First teleoconch whorl with regularly spaced, weak axial threads that become stronger costae on subsequent whorls where they are decussated by sharp incised spiral striations to produce vertically elongate granules slightly higher than wide (Figures 1, 2). Granules strongest above whorls periphery, becoming slightly smaller toward base. Along suture, clusters of 2–3 costae become enlarged and coalesce forming strong, irregularly spaced and irregularly sized white denticles that crenulate the suture (Figure 2a). Band of denticles not demarcated from incremental costae by an impressed spiral groove along their bases. Aperture relatively narrow and sinuous, widest near base, aperture length 0.51–0.57 times shell length. Parietal wall nearly straight, weakly concave in outline. Parietal callus thin, translucent white. Outer lip nearly uniformly arched. In lateral view, outer lip slightly arched forward below periphery (Figure 2). Columella relatively short and strongly twisted at about 20–30° to shell axis, extending slightly forward.

Type Material: Holotype: UF 476155; collected 3 March, 1994 by Fred G. Thompson. Paratypes: UF 221084 (3 specimens), all from type locality; UF 221056 (2 specimens), a heavily forested limestone sink 2.5 km southeast of San Luís de Planes, 1400 m alt., collected 2 March 1994 by Fred G. Thompson and Steven P. Christman.

Type Locality: Honduras, Dept. Santa Barbara, San Luís de Planes (14.9833° N, −88.1333° W); 1300 m alt.

Other Localities: Honduras, Dept. Santa Barbara, north slope of Cerro Santa Barbara, 4 km south of San Luís de Planes, 1700 m. alt. 3 March 1994 (UF 221717 - a single specimen was accidently crushed by the author when stepped on).

Distribution: Honduras, known only from the vicinity of the type locality between 1300–1700 m alt.

Comparisons: *Euglandina* (*E.*) *gigantea* Pilsbry, 1926 from Costa Rica is similar in shape and in size. It measures up to 90 mm long with up to 7.3 whorls. The apical whorl is flat, revolving in a plane, not elevated as in *E. hyperion* new species. The color of the shell is light-orange with irregularly spaced longitudinal dark orange streaks. The suture is bordered by a band of nearly uniformly sized elongate denticles that weakly crenulate the suture. The decussated axial sculpture consists of granules that are nearly as wide as high. The denticles along the suture are separated from the sculpture below by a weakly impressed spiral groove. The aperture is more elongated, 0.57–0.68 times the shell length (see Thompson, 1987).

Euglandina sowerbyana sowerbyana from eastern Mexico has an elliptical-ovate shell with a convex spire. The subspecies *E. sowerbyana estephaniae* differs from *E. s. sowerbyana* and *E. hyperion* by its slenderer form and smaller size.

Euglandina aurata from Guatemala also is smaller and slender, has a weakly beaded suture and a nearly vertical columella. *Euglandina titan* from Guatemala is a very large obese species with nearly smooth incremental threads that are not decussated by spiral sculpture, and has minute beads that weakly crenulate the suture. *Euglandina hyperion* new species is similar to the following species, as discussed below.

Etymology: The species name, a noun in apposition, honors *Hyperion* (Ὑπέριον), a Titan god, son of Gara and Uranus, from the Classical Greek mythology.

***Euglandina encladus* new species**
(Figures 3–5)

Diagnosis: Giant species up to 93 mm long, 0.42–0.46 times as wide as long, and elongate-elliptical in shape, with up to 7.3 whorls forming straight-sided spire. Whorls separated by deeply impressed suture. Color light-brown with irregularly spaced, rust-colored streaks and irregular, narrow white zone bordering suture. Sculpture of axial growth threads decussated by spiral striations to form elongate beads twice as high as wide. Suture crenulated by relatively small white denticles. Aperture 0.50–0.55 times shell length. Columella nearly vertical.

Description: Shell is light brown in color with irregularly spaced rust-colored vertical streaks most pronounced on lower two or three whorls (Figures 3–4). Suture bordered below by irregular narrow white zone. Shell about 84–93 mm long in adult specimens, not ponderous in size, 0.41–0.46 times as wide as long. Shell gracefully elongate-elliptical with straight-sided spire. Body whorl not noticeably inflated. Mature specimens with 7.2–7.3 whorls and strongly impressed suture that descends gradually to aperture. Whorls mildly inflated and uniformly rounded between sutures. Protoconch of 3.5 smooth whorls weakly differentiated from teleoconch. First two protoconch whorls smooth. Subsequent whorl bears weak axial striations, which become progressively stronger. Teleoconch sculptured with incremental striations decussated by spiral striation to form elongate granules about twice as high as wide. Spiral striations nearly equally spaced. Decussated sculpture equally developed to base of last whorl. Below suture clusters of 2–3 incremental threads coalesce to form band of white denticles that crenulate suture (Figure 4a). Denticles irregular in size and spacing. Band of denticles not demarcated from sculpture below except in size. Aperture elongate-auriculate. Parietal margin strongly arched and with thin transparent callus. Columella truncated, short, and nearly vertical, lying at about 5–10° angle to shell axis, and weakly advanced at base. Peristome slightly arched forward in lateral profile (Figure 4).

Type Material: Holotype: UF 468668; collected 25 May 1994 by Fred G. Thompson. Paratypes: UF 221542 (9 specimens); UF 221546 (6 specimens), same data as the holotype.

Type Locality: Honduras, Dept. Santa Barbara, east slope of Cerro Santa Barbara 5 km northwest of San Jose de Los Andes (14.9167° N, −88.1° W), 2100 m alt.

Other Localities: Honduras, Dept. Santa Barbara: the east slope of Cerro Santa Barbara, above Las Quebradas, 3 km west of Nueva Esperanza (14.9333 N, −88.0 W), 1200 m alt. (UF 194565); Cerro Santa Barbara, 0.5 km east of Ocotillo (15.1828 N, −87.9583 W), 2100 m alt. (UF 194546, 194547). [Ocotillo is a small community on the east slope of Cerro Santa Barbara. It is not to be confused with El Ocotillo, Dept. Francisco Morazán (13.8333 N, −87.25 W).]

Comparison: *Euglandina encladus* is similar to *E. hyperion*. It differs from the latter species by its elongate-elliptical shape, by having a deeply impressed suture, by its rust-colored streaked color pattern, by the sculpture of the teleoconch and by the development of the columella. The sculpture of *E. encladus* has elongate granules that are about twice as long as wide. The parietal margin of the aperture is arched into the aperture and the columella is longer and it is more nearly vertical. *Euglandina hyperion* is ponderous with about 7.7–8.0 whorls, has a tumid body whorl, a weakly impressed suture, and a nearly uniformly colored shell that does not have distinct rust-colored streaks. The granular sculpture is nearly as wide as long. The parietal margin of the aperture is very weakly curved and the columella is shorter and strongly curved.

Etymology: The specific epithet *enceladus* (*Ενκέλάδυς*), honors the son of Gaia (Earth) and Uranus (Sky), a Giant from the Classical Greek mythology.

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Book Review

Giving voices to mollusks, a review of *Shells on a Desert Shore: Mollusks in the Seri World*

Cathy Moser Marlett. 2014. **Shells on a Desert Shore: Mollusks in the Seri World.** University of Arizona Press, P.O. Box 210055, Tucson, AZ 85721 USA, 304 pages, ISBN: 978-0-8165-3068-7, US$75.

Mollusks and humans have made history together for a very long time. One hundred thousand years ago, humans in South Africa used the shells of *Haliotis midae* Linnaeus, 1758 to mix an ochre pigment (Henshilwood et al., 2011). Excavations of midden mounds on southern California's Channel Islands (Erlandson et al., 2011) revealed that 12,000 years ago the Paleoindians were seafaring, coastal foragers, consuming mussels (*Mytilus californianus* Conrad, 1837) and gastropods (*Haliotis rufescens* Swainson, 1822 and *Tegula funebralis* (A. Adams, 1855), as *Chlorostoma funebralis*). Far from coastal shorelines, the buried ruins of Templo Mayor, Tenochtitlan (Mexico City) have yielded ornaments made from 15 species of Pacific (Panamic) and Caribbean seashells. These ritual offerings were only encountered in Construction Phases V–VIII (1440–1520 C.E.) of the Templo, after the consolidation of their builders' empire from coast to coast (Velázquez Castro, 2007).

The Seris have for millennia lived along the Gulf of California coastline of northwest Sonora, Mexico. Although this culture is subtly and complexly intertwined with mollusks, the archaeological record is little studied; their midden mounds and ancient campsites contain ceramics and worked stones, and shell remains appear to be those primarily left after consumption. Their unique status is in the people today who talk of their hunter-gatherer parents and grandparents, and how they used, named and thought mythologically of mollusks—literally giving voices to mollusks. Where else can we hear a song (this book, pp. 169–170) about a yellow-footed gull (*Larus livens* Dwight, 1919) eating a sea hare (*Aplysia californica* J.G. Cooper, 1863)?

"The sea hare bursts,
The sea hare bursts,
Hatx cöcazoj immaptx
I burst it!
I burst it!"
Iiqui ihyamaptx

sung by Angelita Torres in her native, endangered language!

Shells on a Desert Shore (Figure 1) is a magnificent tour-de-force, a brilliant combination of marine biology, linguistics, ethnomalacology, and cultural history. It describes the world of the *Comcaac* (the Seri people) and their relationships with mollusks.

Author Cathy Marlett grew up among them, playing with her childhood friends on the seashore near her family's home in the village of *Haxöl Iihom*. The very name of this village reflects the Seri people's immediacy with mollusks and their desert/ocean environment. It means, "the place of the *haxöl*" [that is, "clams," specifically *Leukoma grata* (Say, 1831)]. On Mexican maps it is called El Desemboque, referring to the "mouth of the river" (San Ignacio). Names and naming, uses and meanings, essential to the everyday life of these indigenous Mexican people, are the heart and soul of this book.

Information is presented in three parts, with eight appendices. Part I, "The Setting," introduces the Seri people and their language and physical setting, with an historical summary of previous descriptions of the Seri uses of mollusks. Most formative for Marlett were the decades she spent with her parents, Edward and Mary Beck Moser, living among the Seris. Based on decades of friendships and conversations, they recorded a wealth of material on the Seri language and culture. In addition to her own extensive interviews, her father's detailed notes (written on 3×5 inch paper slips) on Seri names with English translations and a brief description, form the oral history on which this book is based. She writes, "My research method primarily involved showing shells to people, as touching something seemed to be the best way to initiate recollections. . . .Nearly all of my research was done in the Seri language, which I have spoken since childhood" (pp. 13–14). This research methodology makes this book unique—the ethnographic, linguistic, biological, and cultural information was obtained by a "native speaking researcher," not one who had to learn an indigenous lifestyle nor language as an outsider.

Part II, "Mollusks in the Seri Culture," gives a thematic overview of Seri ethnography, including topics such as classification and naming (including orthography, grammar and meanings of Seri words), mythology and folklore, food, utensils (they did not shape the clam shells to form spoons or drinking utensils, but used them as is), medicine and recreation. A favorite boys' game was throwing *Chione californiensis* (Broderip, 1835) clam shells at a *cardón* cactus, the winner having the most stuck in the cactus (Figure 2).

Part III, "Species Accounts," comprises the majority of the text. Most species described are bivalves (80 species in 26 families) and gastropods (104 species in 49 families), but chitons and octopuses and other marine invertebrates are also covered. All species are illustrated with exquisite line drawings by the author; the Latin binomial is followed by a brief description of the shell and its distribution or occurrence. Known Seri names are given

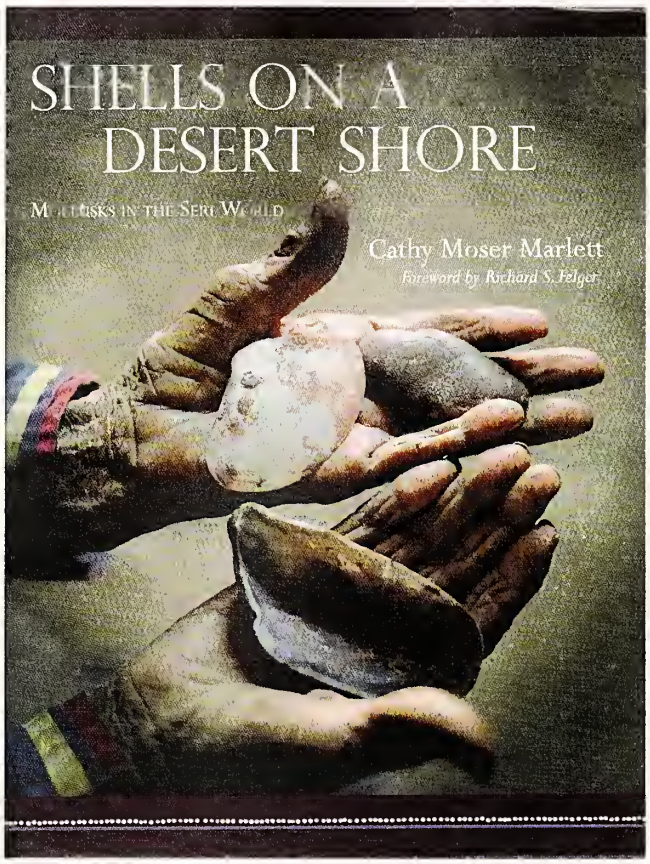

Figure 1. *Shells on a Desert Shore: Mollusks in the Seri World.*

Figure 2. *Chione californiensis* shells thrown by Seri children at a *cardón* cactus (Photo © C.M. Marlett).

and translated, along with their etymology. Known uses are described, often in quite personal terms: "Xavier Moreno and several other men free-dove for the thorny oyster (*Spondylus limbatus*) during the 1980s in areas to the north of Desemboque...Xavier described opening its shell underwater with a knife...[and] added rather matter-of-factly that in order to dive with confidence he had to decide beforehand that if the bivalve closed on his finger, trapping him underwater, he would be prepared and willing to cut off his own finger in order to free himself" (p. 102).

The large, vivid yellow *Laevicardium elatum* (G. B. Sowerby I, 1833) (its Seri name *xtiip* is a primary name, without a derived meaning) was the most heavily used shell in Seri culture. It was used as a food and pigment container, as a tool for excavating a grave or groundwater, as a dipper for water, cactus fruit wine or cooked sea turtle oil mixed with blood, as a cocoon rattle, and of course it was eaten (pp. 106–109).

Women paddled balsa canoes with pen shells [e.g., *Pinna rugosa* (G.B. Sowerby I, 1835)] when crossing to a nearby island for a pelican hunt. *Pinna rugosa* byssal fibers were sometimes sewn as hair to the head of a cloth doll (p. 90).

The slipper shell *Crepidula onyx* G.B. Sowerby I, 1824 was named *casquim quih iti ihiij*, "where the paddler sits" (p. 141). Their name for *Plicopurpura pansa* Gould, 1853 translates as "ringworm medicine," for its medicinal use (p. 153). They spent a lot of time in the intertidal zone under the hot, bright Sonoran sun, so when they found the brilliant yellow-orange slug *Berthellina ilisima* Marcus and Marcus, 1967 underneath a rock it was appropriate to name it *xepenozaali*, "sun in the sea" (p. 170).

Appendices 1–7 are scholarly linguistic charts, variously arranged for easy reference. Appendix 8 is a marvelous biographical recognition of Cathy Marlett's consultants, many with portraits of these kind people.

Shells on a Desert Shore combines the highest linguistic (grammar, orthography, pronunciation, etc.) scholarship with cultural and natural history to explain the role of mollusks in the Seri world. Footnotes contain significant information, and are a "read in themselves." The book is a poem, a multi-sensory experience of a disappearing lifestyle. Numerous photographs (historical and recent) illustrate the people, places and mollusks.

It is an honor to review this book; it has also been my privilege to have known and collaborated with Cathy Marlett. *Shells on a Desert Shore* can be read cover-to-cover, or selectively perused for a specific item of interest. I have done both. For anyone interested in the complex relations between mollusks and humans, the Gulf of California, or the natural history of living mollusks, this book must not only be in your bookcase, but it must also be well read and well used. In the Creation Myth of the Seri, *Conus princeps* Linnaeus, 1758 was sent out to test the newly-formed land to see if it had hardened (p. 165). This book will lead you on an equally engaging voyage of discovery.

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